MYCOLOGIA

VOL. IX JULY, 1917 NO. 4

ILLUSTRATIONS OF FUNGI—XXVI

WILLIAM A. MURRILL

The rosy-spored gill-fungi of North America have recently been monographed in volume 10, part 2, of *North American Flora*, and a summary of the genera and species was published in the last number of *Mycologia*. The accompanying plate represents in their natural colors several species of this interesting group. The original drawings of figures 2, 3, and 7 were made several years ago in Maine by Miss Violette S. White; figure 6 is from a recent sketch by Dr. H. D. House; and the other figures are from originals by Miss Eaton. Other rosy-spored species have been previously illustrated in this series, as follows: *Claudopus nidulans* in Mycologia **6**: *pl. 113, f. 6; Entoloma Grayanum* in Mycologia **5**: *pl. 92, f. 4; Lepista personata* in Mycologia **2**: *pl. 19, f. 1; Lepista tarda* in Mycologia **6**: *pl. 113, f. 4; Pleuropus abortivus* in Mycologia **4**: *pl. 56, f. 12;* and *Pluteus cervinus* in Mycoolgia **1**; *pl. 3, f. 2.*

Entoloma commune Murrill

COMMON ENTOLOMA

Plate 7. Figure 1. × 1

Pileus rather thin, convex, often umbonate, becoming depressed and irregular with age, gregarious to subcespitose, 3–5 cm. broad; surface dry, polished, glabrous, avellaneous-umbrinous, usually darker on the umbo, the cuticle often cracking radially with age, margin concolorous, irregular, usually lobed or split in large specimens; context thin, white, with farinaceous

[MYCOLOGIA for May (9: 129–184) was issued June 9, 1917.]

odor and taste; lamellae more or less sinuate, rather narrow, not crowded, soon becoming rose-colored; spores decidedly angular, apiculate, uniguttulate, rose-colored, copious, 6–8 μ; stipe equal, rather short, often twisted, pruinose at the apex, polished and asbestos-like below, white or pale-avellaneous, 4–5 cm. long, 3–6 mm. thick.

Common about New York City, and found on the ground in woods from New England to the mountains of Virginia.

Leptoniella grisea (Peck) Murrill

GRAY LEPTONIELLA

Plate 7. Figure 2. × 1

Pileus broadly convex or plane, umbilicate, 1.2–2.5 cm. broad; surface striatulate when moist, grayish-brown, glabrous, except on the umbilicus, which is squamulose; lamellae broad, subdistant, grayish; spores subglobose, angular, uninucleate, 7.5–10 μ; stipe slender, hollow, glabrous, concolorous, 3.5–6 cm. long, 2 mm. thick.

A rare species found among sphagnum or in humus in wet woods in Maine and New York.

Entoloma salmoneum Peck

SALMON-COLORED ENTOLOMA

Plate 7. Figure 3. × 1

Pileus thin, conic or campanulate, subacute or with a minute papilla or small cusp at the apex, gregarious, 1.5–3 cm. broad; surface glabrous, moist, salmon-colored, margin sometimes uneven or lobed; lamellae broad, subdistant, ventricose, salmon-colored; spores subglobose, angular, 10–12.5 μ in diameter; stipe slender, equal, glabrous, hollow, concolorous, 7.5–15 cm. long, 2–4 mm. thick.

This beautiful species is frequent in dense woods from New England to Ohio. Dr. Peck selected an excellent name for it.

Entoloma tortipes Murrill

TWISTED-STEMMED ENTOLOMA

Plate 7. Figure 4. × 1

Pileus convex to subexpanded, with a small, conspicuous, conic umbo, rather thin and fragile, reaching 3 cm. broad; surface smooth, with a satiny gloss, rosy-isabelline, margin concolorous, entire, sometimes splitting with age; context very thin, pallid; lamellae sinuate, of medium breadth, subcrowded, slightly ventricose and rounded behind, entire on the edges, pallid to rose-colored; spores ellipsoid, angular, uniguttulate, usually apiculate, rose-colored, 9–11 × 5–7 μ; stipe decidedly tapering upward, conspicuously twisted, smooth, glabrous, polished, white or pale-avellaneous, solid, 6–7 cm. long, 3–6 mm. thick.

Known only from a single collection taken from an old deciduous stump in the New York Botanical Garden.

Entoloma inocybiforme Murrill

INOCYBE-LIKE ENTOLOMA

Plate 7. Figure 5. × 1

Pileus fleshy, fragile, convex to deeply depressed and irregular with age, distinctly umbonate, loosely clustered, abundant, 4–6 cm. broad; surface hygrophanous, glabrous, striate to the small, conic umbo, avellaneous-isabelline, margin concolorous, conspicuously striate, upturned and irregular with age; context very thin, dull-whitish, decidedly farinaceous in taste but without odor; lamellae deeply sinuate, almost free, very broad, ventricose, rather distant, pallid to rose-colored; spores subglobose to broadly ellipsoid, decidedly angular, apiculate, uniguttulate, rose-colored, 8–10 × 7 μ; stipe equal or slightly enlarged at the base, smooth, glabrous, concolorous, solid, 4 cm. long, 5 mm. thick.

This species was found abundant among weeds in the New York Botanical Garden in 1915, but has not been reported since. Its shape and color suggest *Inocybe,* of the rusty-spored series, but the spores are rose-colored.

Eccilia Housei Murrill

HOUSE'S ECCILIA

Plate 7. Figure 6. × 1

Pileus submembranous, campanulate, becoming deeply depressed at the center, cespitose, about 2 cm. broad; surface blackish with a fumosous tint, radiately furrowed and streaked with paler tints, minutely tawny-fibrillose and roughened but scarcely squamulose, margin somewhat irregular; context very thin, pallid; lamellae narrow, decurrent, rather distant, pallid or slightly yellowish when young, soon becoming salmon-colored; spores ellipsoid, angular, obliquely apiculate, rose-colored, 9–11 × 6–7 μ; stipe slender, hollow, grass-green, slightly fibrillose, 2–4 cm. long, 2–3 mm. thick.

Dr. H. D. House, state botanist, collected this species in clay soil in thickets at Green Lake, Onondaga County, New York, June 6, 1914, and referred it to *Leptonia euchlora* Quél. Its grass-green stipe is very characteristic.

Leptoniella subserrulata (Peck) Murrill

SUBSERRULATE-GILLED LEPTONIELLA

Plate 7. Figure 7. × 1

Pileus thin, convex or campanulate, umbilicate, 1.5–3 cm. broad; surface grayish-white, darker colored and squamulose on the umbilicus, margin obscurely striate; lamellae thin, crowded, adnate, at first white, bluish-black and minutely denticulate on the edges; spores irregular or angular, 10–11 × 7.5 μ, usually containing a single large nucleus; stipe slender, rather long, hollow, glabrous, whitish or pallid, 5–7.5 cm. long, about 2 mm. thick.

Described from New York, growing on low ground in woods, and also collected by Miss White in Maine. The gills are white at first, with bluish-black, finely denticulate edges.

Entoloma subjubatum Murrill

SCALY ENTOLOMA

Plate 7. Figure 8. × 1

Pileus convex to expanded, usually somewhat umbonate, becoming quite irregular with age, gregarious, 5–7 cm. broad; surface dry, imbricate-squamulose, especially at the center, fuliginous when young, usually fading to avellaneous with age, the disk remaining darker, margin pallid, usually lobed or cracked in older specimens; context thin, white, without odor, but with a pleasant, nutty-farinaceous taste; lamellae deeply sinuate, broad, ventricose, not crowded, salmon-colored, dark-isabelline in dried specimens; spores ellipsoid, angular, 8–9 × 6–7 μ; stipe cylindric, equal, slightly twisted at times, whitish or avellaneous, pruinose or fibrillose, solid, 6–8 cm. long, 1 cm. thick.

Described from handsome specimens collected by Miss Eaton on the ground in woods in the New York Botanical Garden. It is a rare species, being known only from Massachusetts and southern New York, and resembles *Entoloma jubatum* of Europe.

Eccilia pungens Murrill

PUNGENT ECCILIA

Plate 7. Figure 9. × 1

Pileus convex, not fully expanding, deeply umbilicate, gregarious, 4–6 cm. broad; surface smooth, glabrous, hygrophanous, avellaneous, somewhat striate with darker lines, margin incurved, concolorous, at first entire, becoming conspicuously lobed or plicate with age; context thin, pallid, with a sweetish, pungent taste and a distinct odor of chloride of lime; lamellae short-decurrent, subdistant, arcuate or plane, many times inserted, white to salmon-colored, entire and concolorous on the edges; spores broadly ellipsoid, angular, apiculate, uniguttulate, rose-colored, 8–10 × 7 μ; stipe equal, compressed, solid, smooth, glabrous, subconcolorous, 4–5 cm. long, 4–5 mm. thick.

Known only from specimens collected in woods in the New York Botanical Garden in August, 1915. When fresh, the hymenophores have a sweetish, pungent taste and a distinct odor of chloride of lime.

Entoloma albidum Murrill

WHITISH ENTOLOMA

Plate 7. Figure 10. × 1

Pileus convex to plane or slightly depressed, not umbonate, gregarious, 5 cm. broad; surface smooth, shining, glabrous, white, becoming tinged with avellaneous with age, margin entire or slightly lobed, concolorous; lamellae sinuate, rather narrow, crowded, salmon-colored, entire on the edges; spores globose, angular, apiculate, rose-colored, 7–8 μ; stipe equal or slightly tapering upward, smooth, white, glabrous, stuffed, about 8 cm. long and 1 cm. thick.

This species is white or whitish throughout until the gills are colored by the maturing spores. It was found at Stockbridge, Massachusetts, in September, 1911, in the edge of the woods near the summer home of Dr. W. Gilman Thompson, who was collecting with me at the time.

NEW YORK BOTANICAL GARDEN.

STUDIES OF THE SCHWEINITZ COLLECTIONS OF FUNGI—I

SKETCH OF HIS MYCOLOGICAL WORK

C. L. Shear and Neil E. Stevens

(With Plates 8 and 9)

Introduction

In view of the great importance of Schweinitz's mycological work, it seems desirable to publish certain information which the writers have accumulated and which has a direct bearing on the identification and interpretation of his species, types, and specimens.

Schweinitz's experience and training in Europe in connection with the preparation of the Fungi of Niesky (2) was of great value to him in his later studies of American fungi. His correspondence and exchange of specimens with Fries and Kunze were also of great assistance to him in the identification of American species. The general lack of knowledge of the microscopic characters of fungi at that period and the limitations of time and facilities naturally led to many errors in identification and imperfections in description. Notwithstanding this, Schweinitz must be regarded as the first great American mycologist. Some idea of the extent of his mycological work may be gained from the following summary:

His three published works on American fungi (11, 12, 13) contain a total of 4,491 species. Of these 1,533 were described as new and 10 new genera were established. He states in the index to his herbarium under date of July, 1828, that he had 2,800 specimens of fungi and many more were added later.

The most complete biographical sketch of Schweinitz is that by Walter R. Johnson (6), which was read before the Academy of Natural Sciences of Philadelphia, May 12, 1835, and published the same year. This paper is an appreciation rather than a

biography but contains many of the facts of Schweinitz's life and as it was compiled shortly after his death by a personal friend is the most direct source of information concerning his life and botanical work. Briefer sketches have been published by Morgan (10), Kellerman (7), Shear (14), Harshberger (5), and Lloyd (9). These are largely compiled from the memoir by Johnson and contain no new material.

Unsigned biographical sketches have been published in the Journal of the Elisha Mitchell Scientific Society for 1886 and in Popular Science Monthly for April, 1894. The former (4) appears to have been prepared by Professor J. W. Gore, at that time resident vice-president of the Society. In addition to data given by Johnson this paper contains some material obtained from Schweinitz's second son, Bishop Edmund de Schweinitz, of Bethlehem, Pa. The latter (16) is one of a series of biographies which appeared in Popular Science Monthly, most of which were anonymous and were prepared, presumably, by Dr. William J. Youmans, then editor of the Journal. This paper contains information as to Schweinitz's sons, obtained probably from his second son, Robert.

October 27, 1904, Miss E. A. Lehman presented a paper on Schweinitz (8) before the Wachovia Historical Society, of Salem, N. C. Miss Lehman has informed the writers that the material for this paper was largely furnished by Miss Adelaide Fries, a great granddaughter of Schweinitz who has made a special study of the history of the Moravians in the vicinity of Winston-Salem, N. C.

Recently, in connection with studies of the genus *Endothia*, the writers have had occasion to publish considerable information concerning Schweinitz's methods of work, together with illustrations of some of his manuscripts and specimens.

In addition to these publications the writers have had access to the Schweinitz manuscripts preserved in the library of the Philadelphia Academy of Sciences; his correspondence partly in the possession of his grandson, Dr. George de Schweinitz, of Philadelphia, and partly in the Philadelphia Academy; and many of his letters to Torrey now preserved at the New York Botanical Garden. In assembling information regarding the history

of Schweinitz's collections of fungi, the writers have been assisted by Miss Elsie M. Wakefield, of the Royal Botanic Gardens, Kew, England, Miss Alice Swayne, of Kennet Square, Pa., Mr. Wm. J. Stevenson, Jr., Dr. George de Schweinitz, and Dr. Edward J. Nolan, of Philadelphia, Dr. N. L. Britton, of New York, Mr. Eugene A. Rau, of Bethlehem, Pa., and Dr. W. G. Farlow, of Cambridge, to all of whom they wish to express their great indebtedness and appreciation.

WORK ON FUNGI

Although born in this country (Bethlehem, Pa., Feb. 13, 1780), Lewis David von Schweinitz entered the Theological Institution at Niesky (Prussia), in 1798 and it was there that his first mycological work was done.[1] In collaboration with his teacher, Professor J. B. de Albertini, he published in 1805 the Conspectus Fungorum in Lusatiae. This book contains twelve colored plates, the work of Schweinitz.

He apparently remained at Niesky as student and teacher until 1807 when he was called to Gnadenburg, and subsequently to Gnadau as a preacher in the Moravian Church. From the latter post he came to America in 1812, having been appointed administrator of church estates in North Carolina (8). Before leaving Europe he was married by his friend Albertini, to Louisa Amelia Le Doux, a descendant of a French Huguenot family then residing in Pomerania. Napoleon's military activity made it necessary for them to come by way of Denmark and Sweden, a circumstance which resulted in Schweinitz's becoming acquainted with members of the University at Kiel in Holstein, from which institution he received in the same year the honorary degree of Doctor of Philosophy.

Arriving in this country after a voyage made eventful by the opening of the war between England and the United States Schweinitz and his bride stayed a short time in Bethlehem, Pa. It is probable that his collections in this vicinity were begun at this time, as the fifth species mentioned in his Fungi Carolinae Superioris, which was completed before he took up residence in

[1] Johnson (6) mentions the fact that while a young student at Nazareth, Pa. (1787–1798), he showed great interest in botany and prepared a partial flora of the region.

Bethlehem bears the following comment, "Est tantum in Pensilvania, Bethlehem." According to Miss Lehman he reached Salem, North Carolina, November 14, 1812. Here from the first he devoted much time to the study of fungi.

In his own words,[2]

"When I first came to Carolina I almost exclusively attached myself to the fungi and formed a considerable collection, now amounting to about 1,500 species, entirely from my neighborhood, which still keeps increasing. Of the preservable ones (Fungi) I have with few exceptions preserved specimens in my collection. The Agarici, etc., except the Pleuropodes, I excluded entirely, because, although they may be dried, they lose all their characteristics, and I try to make drawings of such as appear new, and at the beginning of the year I have commenced an augmentation in such a manner that I have 5 parallel collections as complete as I can obtain specimens in order to send to friends who wish to have them."

Schweinitz went to Europe again in 1817 (8) to attend a meeting of his denomination at Herrnhut. He took to Europe on this journey[2]

"My catalog of fungi, together with descriptions of all the new species by me established and specimens of them I took with me to Europe on my visit there in the year 1817–18, and left them in the care of Dr. Schwägerichen at Leipsic to make use of them at his discretion."

Schweinitz apparently returned to Salem in 1819. Miss Lehman speaks of this European visit as lasting three years, but various letters now preserved in his correspondence indicate that he was in Salem in 1819 and the volume of manuscript notes in the Philadelphia Academy of Science bears the superscription

Observations in Cryptogamiam
Salem Carolina
de med. November 1819

19 Nov.

It is evident from this that on his return to Salem Schweinitz again took up the study of the flora, especially the fungi. Shortly after his return Schweinitz welcomed a co-worker, also an officer of the Moravian Church.

"By the Rev. C. F. Denke, lately established in our vicinity, the Botanical Fraternity of North Carolina has obtained a valuable recruit and now forms a Quadro, Rev. Jacob van Vleck, C. F. Denke and myself here, and Professor Mitchell at Chapel Hill."[2]

[2] Letter to Torrey dated Salem, Stokes Co., N. C., Jan. 24, 1820.

Although carried on as an avocation in the midst of pressing church duties, his mycological work bears every evidence of care and accuracy. In the studies on which were based the manuscript taken to Europe in 1817 he certainly made use of a compound microscope of considerable power. That this microscope is the same one to which he refers in 1820 as the "great microscope"[3] and which is now in the possession of his grandson, Dr. Geo. de Schweinitz of Philadelphia (see *Plates 8 and 9*), is very probable, since this instrument was manufactured by Adams of London, and is of a type very closely resembling the "Jones Improved Compound Microscope" (1) manufactured about 1798. This microscope has a set of seven simple objectives numbered 1 to 7, as well as four lenses with polished metallic rims "specula" and is in every respect one of the best instruments made at that time.

Examination and use of Schweinitz's microscope fully confirms Arthur's (3) belief that the reasons for the errors in Schweinitz's descriptions of microscopic characters are to be sought in the imperfections of his instrument. The chief causes of the mistakes were, however, not so much the manner of mounting the spores or the low magnification, as suggested by Arthur, but the lack of spherical and chromatic correction of the lenses and the poor illumination, resulting in very poor definition. An excellent illustration of the imperfections of this instrument can be obtained by examining spores of Schweinitz's *Clasterisporium caricinum* with a modern microscope and comparing the appearance with his drawings (13, *Plate XIX, Fig. 4c*), which are faithful representations of the spores as they appear under his microscope, using objectives 1 and 2.

This inevitable difference in the instruments used by mycologists of successive generations, adds emphasis to the importance of securing and preserving authentic type specimens, and to the value of such type specimens as compared with even the most careful published descriptions. It emphasizes also, as suggested by Arthur, the importance of noting very carefully the kind of microscope used and especially the desirability of preserving microscopes of every period in museums and laboratories.

[3] Letter to Torrey dated June 24, 1820.

Schweinitz continued his study of the flora of North Carolina until his removal to Bethlehem, Pa., late in 1821, probably about November 20.[4] At Bethlehem, Schweinitz came into closer touch with several American students of botany, a circumstance which he evidently greatly appreciated. In the introduction to the Synopsis Fungorum in American Boreali (13 p. 141) he says "Sub finem autem anni jam dicti [1821], in paterna mea domicilia Bethlehem, Northampton County, Pennsylvaniae denum redux. . . .

Botanophili Americani plurimi jam mihi propinquiores, quam degenti olim apud occidentales Carolinenses, penitus toto ab orbe divisos, summa benevolentia et summo studio, quos ipsi invenerant aut quos illis aliunde missi sunt communicaverunt, prae ceteris amicissimus doctissimusque D. John Torrey, Noveboracensis Universitatis Professor."

Torrey was throughout this period Schweinitz's most frequent and valued American botanical correspondent. Torrey at times sent him fungi for identification (15, p. 8), and also loaned him books[5] which happened to be inaccessible, among others Fries's Systema Mycologicum, Pt. 1. At one time Torrey and Schweinitz evidently had under consideration the publication of a joint Cryptogamic Flora.[6]

Schweinitz resided at Bethlehem from 1821 until his death, February 8, 1834, and here he completed, in addition to several papers on higher plants, his most important scientific work, the Synopsis Fungorum in America Boreali (13). During this period Schweinitz twice made journeys on church affairs. In the summer of 1831 he went to Hope, Indiana, to organize a church there. Somewhat earlier he went to Europe to attend a meeting of his denomination at Herrnhut. The date of this journey is given by Johnson and Miss Lehman as 1824, but letters to Schweinitz from Hooker and Torrey indicate that it was made in 1825.[7]

During the latter years of his life Schweinitz regularly used the prefix, de, in his signature, though he never seems to have

[4] Letter to Torrey dated October 29, 1821.

[5] Letter to Torrey dated Bethlehem, May 15, 1822.

[6] Letter to Torrey dated January 16, 1825.

[7] Under date of March 30, 1825, Torrey mentions an effort to meet Schweinitz in New York on the latter's way to Europe.

abandoned the abbreviation, L v S in his manuscripts. This change may have been due to his habitually writing his scientific papers in Latin or, as suggested by Dr. George de Schweinitz in a recent conversation, it may very probably have been done out of consideration for his wife, who, as mentioned above, was of French ancestry. His sons all retained the later form.

MYCOLOGICAL PUBLICATIONS

Following the joint paper with Albertini mentioned above, Schweinitz's next mycological publication was the Synopsis fungorum Carolinae superioris (10). The circumstances of its publication are given in a letter to Torrey.[8]

"I would have deferred writing longer had not the present good opportunity afforded for transmitting to you a copy of a small work bearing my name on its title page, which was sent to me from Germany—to my no small surprize, as I was utterly unaware that it would be published—although I must confess myself the author. I left it with a friend some years ago, without any such idea, but have no objection that he disposed of it that way. Possibly it will be not uninteresting to you, as it contains a list of all the fungi I had observed in N. C. previous to 1817, with definitions of the new ones, and I therefore beg of you to accept it as a token of my friendship."

The date of publication of this paper is given by Johnson as 1818 with the remark: "The date of this paper is only mentioned on personal information." The source of this "personal information" is unknown and there is no definite indication as to its authenticity. The volume, of which this paper forms a part, was published in 1822 and bears that date. Schweinitz's paper is, however, in the early part of this volume (pp. 20–132) and there is a copy of a separate in the Library of the Philadelphia Academy paged 1–105 but bearing no date. This separate was received for the Academy by Z. Collins in December, 1822.[9] That Schweinitz himself did not receive copies of this paper until late in 1822 is shown by the letter just quoted and as he was in Europe during 1818 it is improbable that the paper could have been issued then without his knowledge.

In 1825 Schweinitz published a short paper entitled Description of a number of new American species of Sphaeriae (12).

[8] Letter dated Bethlehem, November 24, 1822.

[9] Letter from Collins to Schweinitz.

As is indicated by the introduction this is supplementary to the paper on the fungi of North Carolina.

Schweinitz's last and most important published work was the Synopsis Fungorum in America Boreali (13). This was published by the American Philosophical Society, Philadelphia, in the volume of Proceedings dated 1834. It was, however, actually issued as a separate two years earlier, as shown by the following note now in the possession of Dr. George de Schweinitz, of Philadelphia.

PHILAD. 29 July 1832.

M. L. D. SCHWEINITZ
Bethlehem

Sir:

By your friend the Pr. of Newid who visits us under the name of Baron de Bramsberg I have the pleasure of sending you six copies of your work making part of one [our] 4th vol. N. S. Copies will go shortly to the Different Academies and Philos Societies of Europe—to the number of about 40—We anticipate the respect with which this valuable work will be received. We have more copies at your service please inform me of the disposition of these.

I remain yours sincerely
JN VAUGHAN
Lib. of Am. Ph. Soc.

In a letter dated October 22, 1832, Torrey acknowledges the receipt of two copies, one intended for Halsey, and takes the opportunity to congratulate his friend on the "completion of this great performance." He adds this pertinent remark, "If we now had the other departments of our Acotyledones finished, we would have our entire Flora *posted up* to the present day. When shall we have our Lichens, our Musci, our Algae & our Hepaticae? Life is too short—too valuable, I ought to have said, for any *one* of us to undertake the whole."

MANUSCRIPTS

Johnson (6 p. 36–38) mentions, in addition to Schweinitz's published works, "other productions of his pen . . . some of which still remain in manuscript." Of these manuscripts a number are known to have been preserved. Mr. Eugene A. Rau informs the writers that he has several manuscripts given to him by one of Schweinitz's granddaughters, among these is Schwei-

nitz's Flora of Salem, North Carolina, which also contains marginal notes of plants that he collected in the vicinity of Bethlehem. The date of this manuscript is 1821—it is a book 8 by 13 inches with 165 pages, of which 120 pages are devoted to Phanerogams, 4 pages to Filices, 11 pages to Musci and Hepaticae, 3 pages to Fresh Water Algae, 22 pages to Lichens.[10] This is evidently the unpublished portion of a flora of the vicinity of Salem, N. C., of which The Synopsis fungorum Carolinae Superioris formed a part.

Mr. Rau also has "an index to his herbarium 1822," a book which "contains a list of his correspondents with their addresses," an "Index Herbar, Europ." and a "list of Amer. Fungi in his collection."[10]

In the Library of the Academy of Natural Sciences, Philadelphia, are the following manuscripts dealing mostly with Fungi:

Schweinitz's Index to his herbarium marked: "Index Herbarii Ludovici Davidis de Schweinitze 1824. Adjectis plantis omnibus Zonae temperatae Graminaceis autem ac Cryptogamis totius orbis."

This is a large folio volume of several hundred pages, not numbered, containing a MS. list in Schweinitz's handwriting of the species contained in his herbarium. There is a final summary on the last page dated July, 1828, giving a list of the various orders of plants and the number of each. The grand total is 16,266 specimens, 2,800 of which are fungi."

Also a manuscript on octavo sheets with the following title:

"Description of some new American Species of the Genus *Sphaeria* being the first Genus of the Second Order *Pyrenomycetes* of the Second Class of Fungi *Gasteromycetes* according to the system of Mycology of Dr. Elias Fries supplementary to the Synopsis of Carolinian Fungi by L. De Schweinitz published in the Comentaries of the Society of Naturalists of Leipzig by Dr. Schwägerichen."

There are also three folio volumes of unpublished plates entitled "Fungorum Nieskiensis Incones" in the library. Mr. Rau states that at one time six or seven volumes of colored plates were loaned him by Schweinitz's son, Bishop Edmund de Schweinitz. Where these are is now unknown. There is now in the possession of Mrs. Lemly, a granddaughter of Schweinitz, of

[10] Extracts from letter written by Mr. Rau, February 8, 1917.

Salem, N. C., a volume of unpublished plates marked Part 1 of the Fungorum Nieskiensis. In the Library of the Philadelphia Academy there are also numerous loose quarto colored plates of American fungi.

At the close of the life of Schweinitz published in the Journal of the Elisha Mitchell Society in this note: (4, p. 25)

"There is also in the possession of his son, Bishop de Schweinitz, of Bethlehem, Pa., a manuscript work entitled: 'Synopsis Fungorum Americanorum qui Ludovicus David de Schweinitz innotuere. Secundum Systema Fries.' This work is different from No. 10 [Synopsis Fungorum in America Boreali media degentium] but whether written before or after is unknown. The manuscript is carefully written in three bound volumes, 8vo: the first having 116 pp., the second 175 pp., the third 100 pp. Some of the pages except the running title on the top are blank and were evidently to be filled out as the researches proceeded."

This manuscript the writers have been unable to locate.

SOURCES OF SCHWEINITZ'S HERBARIUM

On the inside of the title page of the manuscript index to his herbarium in the library of the Philadelphia Academy, Schweinitz lists seventy individuals and herbaria as "contributores." Of these the following are mentioned either in the Synopsis fungorum in America Boreali (13) or in the Synopsis fungorum Carolinae Superioris (11), as having contributed specimens of fungi; Dr. Baldwin, Zaccheaus Collins, John Le Conte, C. F. Denke, Abram Halsey, Dr. Krampman, Dr. John Torrey, and Jacob Van Vleck. European specimens of fungi were sent by Fries, Burkhardt, Kunze, and Schwaegrichen.

Undoubtedly, the greater portion of the herbarium was collected by Schweinitz himself and a very large number of the specimens come from the regions about Salem, N. C., and Bethlehem, Pa., at which places most of his life in this country was spent. Miss Lehman remarks that he collected specimens "of every plant within a radius of 30 miles from Salem," and the localities cited by him indicate that his collecting trips about Bethlehem covered an even greater area. Letters to Torrey speak of collecting trips to "The Grandfather Mountains, [N. C.] . . . chiefly for Cryptogams" and of wishing to get in connection

with Nuttall to get western Cryptogams;[11] also of "making a journey to Muskingum [Ohio] in July;"[12] and of a trip to Lake Erie lasting for a month.[13]

SPECIMENS OF FUNGI DISTRIBUTED BY SCHWEINITZ

From the letter to Torrey quoted above (p.—) it is apparent that Schweinitz on his visit to Europe in 1817–1818, left with Schwaegrichen specimens of all new species of fungi which he had described up to that time. Thus far it has been impossible to locate this collection although the senior author has made a careful search in the principal herbaria of Europe. The only Schweinitzian specimens known to have come from Schwaegrichen's Herbarium are a few which were found in Kunze's collection in the Herbarium of the University of Leipsic and a single specimen, which had apparently been sent to Nees von Esenbeck, in the Herbarium at Strasburg.

From the same letter it is also evident that Schweinitz began at least as early as 1820 the systematic preparation of duplicates for distribution. His method of preparing these duplicates is evident from the original packets preserved in the Philadelphia Academy of Sciences. In some cases there are two or three small packets labeled the same as the larger packet except that they bear the numbers 1, 2, 3, etc. For example "Sphaeria Castanea L. v. S. Beth. & Sal" is on one packet, and on a smaller packet "Sph. Castanea L. v. S. 3." In Kunze's herbarium at Leipsic and in the Link herbarium at Berlin, at Kew, at Upsala, and elsewhere, are autograph specimens of Schweinitz which bear these small numbers.

Throughout Schweinitz's life an active exchange of specimens was carried on between himself and Torrey.[14] Later Torrey presented to Berkeley and Curtis the fungi given him by Schweinitz. Part of this collection is now in Berkeley's herbarium at Kew, and part in the Curtis herbarium at Harvard.

Schweinitz doubtless sent collections of fungi to some of his

[11] Letter dated Jan. 11, 1821.
[12] Letter dated May 25, 1823.
[13] Letter dated Dec. 5, 1827.
[14] Several letters from Schweinitz to Torrey.

correspondents at several different periods. Definite records of these exchanges exist in a few cases. Some time previous to 1824 Schweinitz sent to Abram Halsey, an amateur botanist of New York, a collection of fungi.[15] This collection the writers have endeavored to trace but there seems to be no record of its existence. Descendants of Halsey believe it to have been destroyed by a fire in a Brooklyn Museum.

In 1824 packages of fungi were sent to Hooker[16] and to Fries.[17] Those sent to Hooker are preserved in the herbarium at Kew and Fries's specimens are in the herbarium at Upsala.

Schweinitz's first gift of specimens of fungi to an herbarium in this country seems to have been made in 1827 to the Academy of Natural Sciences, Philadelphia. The exact date and manner of this gift is made clear by the recent discovery in the letter files of the Academy of the following note from Z. Collins.[18]

"The class Pyrenomyceti of Dr. Fries in fourteen genera of North American Fungi to-wit:

Sphaeria	Phacidium
Lophium	Hysterium
Sphaeronema	Glonium
Cytisporea	Actidium
Phoma	Actinothyrium
Dothidia	Sacidium
Rhytisma	Leptostroma

In upwards of 500 species. Deficient in 150 species. From the collection of Mr. L. D. Schweinitz and by him presented to the A. N. S. through his friend Z. Collins. March 20, 1827."

Comparing the lists in Schweinitz's handwriting on the packets in the collection with the above note it is evident that they agree except that Collins omitted one genus, namely Prostemium, when he listed them. A memorandum by Schweinitz on the last folder, Number 10, says: "Summa Pyrenomycetorum 527—Desunt 153."

This collection is in ten small folio heavy paper wrappers with

[15] In an undated letter to Schweinitz Halsey thanks him for the "Highly prized collection [of fungi] you have some time since sent me." Elsewhere in the letter he says, "I have just received from Hamburg, the 1st vol. of the Bryologia Germanica by Nees & Hornschurch, . . . just printed." The date of this publication was 1823.

[16] Letter from Hooker dated July 2, 1825.

[17] Letter from Fries dated April 15, 1824.

[18] This note is in the file dated 1826–1840 under the letter "S."

lists of the inclosed genera and species on the outside. The species are in small paper packets bearing Schweinitz's autograph labels. These packets rarely bear the small numbers used on his regular duplicates and were evidently taken in case no number occurs from the original packet of the species. To distinguish this collection from the Schweinitz Herbarium later bequeathed to the Academy, the writers will refer to this as the "Collins collection."

Brongniart[19] in a letter dated April 24, 1829, and Greville[19] in a letter dated 1830, acknowledge the receipt of collections of plants from Schweinitz. Brongniart speaks specifically of Cryptogams. These were in part at least fungi, as autograph specimens of fungi from Schweinitz are found in the Brongniart herbarium at Paris and in Greville's herbarium at Edinburgh. In a letter dated 1830 Dr. Zeyher, director of the Botanic Garden at Schwetzingen, acknowledges the receipt of specimens of fungi.

In addition to the specimens listed above the senior writer has examined autograph specimens of fungi in the following herbaria: that of Kunze at Leipsic, of Jacquin at Vienna, of Link and of Ehrenberg at Berlin, and of Nees von Essenbeck at Strasburg.

BUREAU OF PLANT INDUSTRY,
WASHINGTON, D. C.

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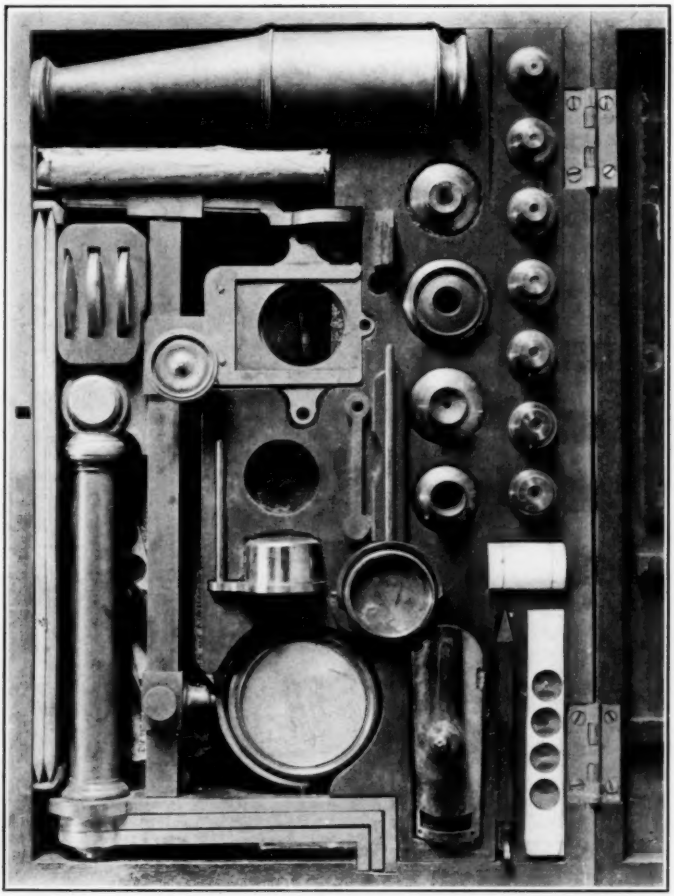
MICROSCOPE OWNED AND USED BY SCHWEINITZ IN HIS STUDIES OF FUNGI



SCHWEINITZ' MICROSCOPE WITH ACCESSORIES IN ITS CASE

NORTH AMERICAN SPECIES OF PUCCINIA ON CAREX[1]

FRANK D. KERN

In spite of an accumulation of considerable information concerning the North American sedge rusts most mycologists have regarded this group as especially difficult. This is perhaps due to the fact that the telia and teliospores do not usually present diagnostic characters. In the characterization of these species it has been necessary to look for other features, and as has been the case in several other groups of the rusts, it has been found that the urediniospores have furnished reliable characters in many instances. The aecial connections as brought to light by cultures are also important. The presence of amphispores in some of these species, the correlation of some species with forms usually regarded as belonging to another genus, and the splitting of other species into races lend general biological interest to these studies.

In order that the results may be made as available as possible to those wishing to collect, or determine specimens of the group, considerable attention has been given to the preparation of keys and indices. The key relating to the aecial forms is somewhat unique and yet it is believed that even a cursory glance will reveal the way in which it may be useful. It is the idea that anyone having an aecial stage on a known genus of host should be able to make out whether or not it belongs to a Carex rust, and if so, to locate the species without difficulty. No host bears the aecia of more than one species. Altogether thirty genera serve as aecial hosts distributed among ten families, only one of which is monocotyledonous. Eight orders are represented. The following table shows the distribution of the aecial hosts.

[1] Read before the Botanical Society of America at the New York meeting, December 30, 1916. Contribution from the Department of Botany, The Pennsylvania State College, No. 10.

TABULAR VIEW OF THE AECIAL HOST FAMILIES

Class	Order	Family	Fam. No.*	Genera†
Monocotyledoneae	Liliales	Smilaceae	25	1
Dicotyledoneae	Urticales	Urticaceae	43	2
	Rosales	Grossulariaceae	84	1
	Myrtales	Lythraceae	128	1
		Onagraceae	130	4
	Primulales	Primulaceae	142	2
	Polemoniales	Phrymaceae	169	1
	Rubiales	Caprifoliaceae	172	1
	Campanulales	Cichoriaceae	179	7
		Carduaceae	181	10

* The number given here is the serial number of the families of the angiosperms according to Britton & Brown, Illustrated Flora, 2d edition.

† The numbers in this column indicate the number of genera in a family known to bear aecia.

Under the accounts of the species it has been the aim to include various notes which might not find a place in a purely systematic presentation. No attempt has been made to describe the aecial stages and for the sake of brevity the descriptions of the uredinial and telial stages have been confined chiefly to the spores, the sori being mentioned in only a few instances because they do not furnish diagnostic characters as a rule. Nineteen species are now recognized, of which twelve have their life-histories worked out, three possess amphispores, and three are described as new. Six of the species are common to Europe and North America, one to Asia and North America, and one is known to occur also in South America. A total of 139 species of *Carex* are listed in this paper as hosts for the species of *Puccinia*. In 1913, 106 *Carex* species were known to serve as hosts which were then represented by 1200 North American collections in the Arthur Herbarium.[2] It is not known how many collections have been added during the last three years but the herbarium has been increasing rapidly.

No effort has been spared to make the host determinations as authentic as possible and in this connection thanks are due to Dr. Theo. Holm, of Washington, D. C., and to Mr. K. K. Mackenzie, of New York, for their painstaking examination of specimens

[2] Other interesting statistics regarding the North American Carex rusts are given by Professor Arthur in Mycologia 5: 240–244 (1913).

submitted to them. This work of host determination has been tedious; the opening of the mycological packets and the fragmentary condition of many of the specimens must frequently have been irksone to phanerogamic botanists but these gentlemen have most cheerfully responded to numerous requests for identification.[3]

In making up the lists of hosts under the different species only the names considered to be most acceptable are included, omitting all which are regarded as synonyms. In order to make these synonyms, some of which may be commonly known, also available they are included in the Index to Rusts Occurring on Various Species of Carex at the end of this paper, with proper cross references.

The studies have been carried on over a considerable interval, ten years or more, during which time the routine duties of teaching and experiment station work have claimed the larger share of effort, and yet there has been a continuous interest and numerous periods of varied extent have been devoted wholly to this group. The work which has been done directly with the idea of preparing a monographic account has been made possible only by the initial and continued support of Professor J. C. Arthur and his staff of botanical assistants, among whom Miss Mary A. Fitch deserves especial mention. The painstaking observations and careful records made by Miss Fitch at a time when the whole matter was in a very chaotic condition assisted very materially in establishing a working basis. Five years ago a paper entitled A Revision of the North American species of Puccinia on Carex was presented in brief form by the writer before the Botanical Society of America.[4] Miss Fitch was included as a joint author but the paper was published only in abstract form.[5] Since that presentation the studies have been continued, but without the aid of Miss Fitch, and the results of the more recent work are incorporated in this paper. The value of the foundational work of Professor Arthur and of his continued assistance cannot be overestimated.

[3] For notes concerning the activities of Dr. Holm see Torreya **13**: 72 (1913) and Mycologia **5**: 240–244 (1913).

[4] Washington meeting, December 27, 1911.

[5] Science, N. S. **35**: 150. 1912.

For collections of specimens and suggestions as to relationships thanks are due to generous friends in various parts of the country and are hereby most heartily accorded.

A. Uredinia and telia exclusively considered

Host belonging to genus *Carex* (family Cyperaceae).
- Urediniospores with pores in an equatorial zone.
  - Pores 2 (in occasional spores 3).
    - Urediniospores medium-sized (16–21 × 20–26 μ), wall 1–2 μ thick.
      - Urediniospores of the modified sort (amphispores) unknown ..... 1. *P. Kellermanii.*
      - Urediniospores of the modified sort (amphispores) with chestnut-brown wall, thicker above ..... 2. *P. atro-fusca.*
    - Urediniospores very large (26–37 × 35–61 μ), wall 2.5–3.5 μ thick ..... 3. *P. macrospora.*
  - Pores 3 (in occasional spores 4).
    - Urediniospore-wall moderately thick (2 μ and more) ..... 4. *P. spatiosa.*
    - Urediniospore-wall moderately thin (2 μ and less).
      - Urediniospores rather large (18–26 × 24–39 μ).
        - Teliospores small (26–42 μ long). 5. *P. minuta.*
        - Teliospores large (39–71 μ)..... 6. *P. urticata.*
      - Urediniospores medium-sized (15–21 × 19–32 μ).
        - Teliospores moderately small (32–45 μ long); urediniospore-wall cinnamon-brown ..... 7. *P. Lysimachiae.*
        - Teliospores medium-sized (32–58 μ long), urediniospore-wall golden-brown ..... 8. *P. Grossulariae.*
        - Teliospores large (45–67 μ long), urediniospore-wall cinnamon-brown ..... 9. *P. eminens.*
  - Pores 4, urediniospores pale yellow; urediniospores of the modified sort (amphispores), chestnut-brown with 2 equatorial pores.....10. *P. microsora.*
- Urediniospores with pores in an extra-equatorial zone.
  - Pores 2, above the equator.
    - Pores slightly above the equator, i. e., superequatorial.
      - Urediniospores small (12–18 × 16–21 μ) wall golden-brown. .....11. *P. minutissima.*
      - Urediniospores medium-sized (15–

20 × 20–26 μ) wall cinnamon-brown ..... 12. *P. universalis.*
Pores considerably above the equator, i. e., in the upper part of spore.
Urediniospores small (12–19 × 16–23 μ).
Teliospores small (29–45 μ long) .. 13. *P. Phrymae.*
Teliospores medium-sized (25–50 μ or more, long) ..... 14. *P. asterum.*
Urediniospores medium-sized (15–20 × 19–26 μ).
Telia roundish or oval, comparatively broad ..... 15. *P. Peckii.*
Telia mostly oblong or linear, comparatively narrow ..... 16. *P. patruelis.*
Urediniospores rather large (17–23 × 24–32 μ), chiefly lenticular ..... 17. *P. Sambuci.*
Pores 1 or 2, below the equator.
Pores 2, slightly below the equator, i. e., subequatorial ..... 18. *P. Caricis-strictae.*
Pore 1, considerably below the equator, near the hilum ..... 8. *P. Grossulariae.*
Urediniospores with scattered pores ..... 19. *P. karelica.*

B. Aecia exclusively considered

Aecia scattered, from diffused mycelium ..... Excluded.
Aecia grouped, from limited mycelium.
Aecia rupturing by an ostiolar pore ..... Excluded.
Aecia cupulate.
Host belonging to family Smilaceae (genus *Smilax*).
Aeciospores medium-sized (15–26 μ), the wall uniform ..... Excluded.
Aeciospores very large (32–51 μ), the wall much thicker above ..... 3. *P. macrospora.*
Host belonging to family Urticaceae.
Host belonging to genus *Boehmeria*, aeciospores very small (10–13 μ) ..... Excluded.
Host belonging to genus *Urtica*, aeciospores medium-sized (15–23 μ) ..... 6. *P. urticata.*
Host belonging to family Grossulariae (genus *Ribes*) ..... 8. *P. Grossulariae.*
Host belonging to family Lythraceae (genus *Decodon*) ..... 11. *P. minutissima.*
Host belonging to family Onagraceae.
Host belonging to genus *Ludwigia* or *Anogra* ..... Excluded.
Host belonging to genus *Gaura, Onagra, Meriolix*, or *Pachylophus* ..... 15. *P. Peckii.*

Host belonging to family Primulaceae.
- Host belonging to genus *Glaux* or *Steironema* ..... Excluded.
- Host belonging to genus *Lysimachia* ..... 7. *P. Lysimachiae.*
- Host belonging to genus *Trientalis* ..... 19. *P. karelica.*

Host belonging to family Phrymaceae (genus *Phryma*) ..... 13. *P. Phrymae.*

Host belonging to family Caprifoliaceae (genus *Sambucus*) ..... 17. *P. Sambuci.*

Host belonging to family Cichoriaceae.
- Host belonging to genus *Lampsana* ..... Excluded.
- Host belonging to genus *Adopogon, Agoseris, Crepis, Lactuca, Nothocalais, Hieracium* or *Prenanthes* ..... 16. *P. patruelis*

Host belonging to family Carduaceae.
- Host belonging to genus *Ageratum, Arnica, Bahia, Bigelovia, Boltonia* (uncertain), *Borrichia, Carduus, Chrysogonum, Chrysopsis, Chrysothamnus, Cirsium, Clibadium, Coleosanthus, Conoclinium, Desmanthodium, Dugaldia, Eriophyllum, Eupatorium, Gnaphalium, Gutierrezia, Gymnolomia, Helenium, Helianthus, Helianthella, Heliopsis, Laciniaria, Montanoa, Polymnia, Rudbeckia, Senecio, Silphium, Verbesina, Ximenesia,* or *Zexmenia* ..... Excluded.
- Host belonging to genus *Aster, Doellingeria, Eucephalus, Euthamia, Erigeron, Grindelia, Leptilon, Oreochrysum* or *Solidago* ..... 14. *P. asterum.*
- Host belonging to genus *Artemisia* ..... 12. *P. universalis.*

1. **Puccinia Kellermanii** sp. nov.

O & I. Pycnia and aecia unknown.

II. Urediniospores ellipsoid, 18–21 × 25–28 μ; wall light golden-brown about 1.5 μ thick, moderately and distinctly echinulate, the pores 2, or sometimes 3, equatorial.

III. Telia scattered, chiefly on the upper part of the culm or on the rachis, oval or oblong, 0.4–0.8 mm. long, early naked, chocolate-brown; teliospores clavate-oblong, 16–21 × 39–45 μ, rounded or sometimes narrowed above, usually narrowed below, slightly constricted at the septum; wall varying from golden- to chestnut-brown, 1–1.5 μ thick, much thicker above, 9–10 μ; pedicel tinted next to the spore, once to once and a half length of spore.

On *Carex polystachya.*

Type collected near Antigua, Depart. Sacatepéquez, Guatemala, Feb. 3, 1908, *W. A. Kellerman, 7197;* other collections San Rafael, Jan. 10, 1915, *55*, and Solola, Jan. 27, 1915, *124*, both by *E. W. D. Holway*.

The Guatemalan collections here listed are used as the foundation of a new species. The pore arrangement throws this species in a group with *P. atro-fusca* and *P. macrospora* from which it differs markedly in other spore characters. There is a general resemblance to *P. urticata* but the pores in the Guatemalan specimens are usually 2, sometimes 3, whereas they are usually 3, rarely 4, in *P. urticata;* there are also differences in teliospores. The variations in spore characters plus the geographic interval between these specimens and any of the other species makes it seem wise to characterize a new species.

2. PUCCINIA ATRO-FUSCA (Dudley & Thomp.) Holway, Jour. Myc. **10**: 228. 1904

Uromyces atro-fuscus Dudley & Thomp. Jour. Myc. **10**: 55. 1904.

O & I. Pycnia and aecia unknown.

II. Urediniospores of the typical sort broadly ellipsoid, 16–21 × 21–26 μ; wall cinnamon-brown, 1.5–2 μ thick, rather closely echinulate, the pores 2, equatorial; urediniospores of the modified sort (amphispores) broadly ellipsoid or obovoid, 17–24 × 23–32 μ; wall chestnut-brown, 2.5–3.5 μ thick, somewhat thicker above, 4–7 μ, rather sparsely but prominently verrucose-echinulate especially above, the pores 2, approximately equatorial.

III. Teliospores narrowly obovate-ellipsoid or clavate-oblong, 16–22 × 30–43 μ, rounded or obtuse at each end, slightly constricted at the septum; wall chestnut-brown, 1.5–2 μ, much thicker above, 5–7 μ; pedicel slightly tinted, about length of spore.

On *Carex Douglasii, nigricans, praegracilis, siccata.*

DISTRIBUTION: Southern Alberta, Montana, and New Mexico west to the Pacific Coast.

EXSICCATI[6]: Barth. N. Am. Ured. *820, 1027;* Clements, Crypt. Colorad. Form. *547*; Barth. Fungi Columb. *2676, 3742*.

[6] In listing the Exsiccati those on the *Carex* host are given first and italicized; those on the aecial host are set apart by a dash and are not italicized.

The chief point of interest in connection with this species is the presence of two sorts of urediniospores. The urediniospores of the modified sort have been called amphispores. The chief modification is a greater thickness of wall presumably fitting them for living over winter. In some species amphispores are modified as to markings and pore arrangement. In this species the markings are more verrucose in their nature and more prominent but the pore arrangement is the same. The characters of the sori differ also, the amphisori being twice as large, more pulvinate and dark-chocolate-brown as compared with the cinnamon-brown uredinia. These amphispores have never been germinated but in other cases amphispores have been demonstrated to germinate and produce infection in the same manner as urediniospores.

3. PUCCINIA MACROSPORA (Peck) Arth. Mycologia **1**: 244. 1909
Aecidium macrosporum Peck, Ann. Rep. N. Y. State Mus. **23**: 61, 1873. Not *A. macrosporum* Diet. & Neg. 1896.

O & I. Pycnia and aecia on *Smilax* spp. (For cultures see Mycologia **1**: 243, 1909.)

II. Urediniospores obovate or narrowly ellipsoid, rather irregular, very large, 26–27 × 35–61 μ, often narrowed below to a thickened hilum; wall golden yellow, 2.5–3.5 μ thick, echinulate with prominent points 3–4 μ apart, the pores obscure, 2, or sometimes 3, equatorial.

III. Teliospores clavate, 16–23 × 61–67 μ, usually rounded or obtuse above, narrowed below, often slightly constricted at the septum; wall pale-cinnamon-brown, paler below, 1.5–2.5 μ, much thicker above, 9–16 μ; pedicel colorless, one half to once length of spore.

On *Carex comosa*.

DISTRIBUTION: Limited area near the coast from Long Island to Delaware, with a single collection of aecia from Kansas.

This is a remarkable but little known species. The very large size of the urediniospores even when compared with the form belonging to *Urtica*, which has always been regarded as having large urediniospores, attracts immediate attention. The aeciospores are also exceedingly large (32–42 × 37–51 μ) and it was in fact the similarity in these spore structures which was chiefly

responsible for the original culture. There are other cases where morphological correspondence between aeciospores and urediniospores has led to successful connections (see Arthur, Bot. Gaz. **29**: 274–275, 1900). Such cases tend to indicate a possible homology between these spore forms.

4. **Puccinia spatiosa** sp. nov.

O & I. Pycnia and aecia unknown.

II. Urediniospores broadly ellipsoid, 26–29 × 30–39 μ; wall light cinnamon-brown, 2–2.5 μ thick, sparsely and conspicuously echinulate, the pores 3, or sometimes 4, approximately equatorial.

III. Telia oval oblong or linear, 0.5–1 mm. long, blackish; teliospores narrowly obovoid, 24–29 × 45–64 μ, considerably constricted at the septum, rounded above, rounded or narrowed below; wall chestnut-brown, 1.5–2 μ thick, very much thicker above, 16–23 μ; pedicel nearly colorless, once to once and a half length of spore.

On *Carex* sp.

Type collected at Brookings, S. D., March 21, 1908, *A. G. Johnson*.

So far as pore characters are concerned the form here described agrees with a group of species, of which the forms having aecia on *Urtica* and *Ribes* are prominent members, but it differs from all of these in having more robust especially broader spores, both uredinio- and teliospores. As compared with the usual oblong-clavate teliospores of the sedge rusts these are broad enough and rounded above so as to give an obovoid effect.

5. PUCCINIA MINUTA Dietel; Atkinson, Bull. Cornell Univ. **3**: 19, 1897

Puccinia riparia Holway, Jour. Myc. **10**: 163, in part. 1904.

O & I. Pycnia and aecia unknown.

II. Urediniospores broadly ellipsoid or obovoid, 19–26 × 26–39 μ; wall cinnamon-brown, about 1.5 μ thick, evenly and rather sparsely echinulate, the pores 3, approximately equatorial.

III. Teliospores clavate-oblong or cuneate, small, 13–23 × 26–42 μ, rounded or truncate above, not or only slightly constricted at the septum; wall light chestnut-brown, 1–1.5 μ thick, much thicker at apex, 5–10 μ; pedicel slightly tinted, about one-half length of spore.

On *Carex lacustris, verrucosa.*

DISTRIBUTION: Known only from separated localities, Ontario, Wisconsin, Iowa, and Alabama.

The name *minuta* was applied by Dietel to a specimen collected at Auburn, Alabama, on *C. verrucosa,* the striking characters of which are the moderately large urediniospores and the very small teliospores. *Puccinia riparia* as described by Holway possessed these same characters and his specimens agree well with Dietel's material. Mr. Holway thought that the telial form which he described was associated with an aecidium on *Ribes floridum* but repeated attempts to infect *Ribes* with these spores from *C. riparia* have failed (Bot. Gaz. **35**:22, 1903, Jour. Myc. **14**:14, 1908). Infection has been secured from *C. riparia* on *Urtica* but the spores are quite different from those included here. From these results it is assumed that there must have been some error about Holway's procedure. The name which he proposed evidently belongs here in part and with *Puccinia Grossulariae* in part.

6. **Puccinia urticata** (Link.) comb. nov.

Aecidium Urticae Schum. Enum. Pl. Saell. **2**:222. 1803.
?*Uredo Caricis* Schum, Enum. Pl. Saell. **2**:231. 1803.
Caeoma Urticae Schlecht. Fl. Berol. **2**: 112, 1824.
Caeoma urticatum Link. in Willd. Sp. Pl. **6**²:62. 1825.
Puccinia Caricis Schroet. Krypt.—Fl. Schles. **3**: 327. 1887. Not *P. Caricis* Reb. 1804.
Puccinia Urticae Lagerh. Mitt. Bad. Ver. **2**:72. 1889. Not *P. Urticae* Barcl. 1887.
Dicaeoma Urticae Kuntze, Rev. Gen. **3**³:467. 1898.
?*Dicaeoma Caricis* Kuntze, Rev. Gen. **3**³:468. 1898.
Puccinia Garrettii Arth. Bull. Torrey Club. **32**:41. 1905.

O & I. Pycnia and aecia on *Urtica* spp. (For cultures see Bot. Gaz. **29**:270, 1900, **35**:16, 1903: Jour. Myc. **12**: 15, 1906, **14**:14, 1908, Mycologia **2**:223, 1910, **4**:17, 1912.)

II. Urediniospores broadly ellipsoid, rather large, 18–25 × 24–35 μ; wall golden-brown, 1.5–2μ thick, rather sparsely echinulate, the pores 3, rarely 4, equatorial.

III. Teliospores mostly clavate, 15–23 × 39–71 μ, usually rounded above, the upper cell much broader and shorter than the

lower one, narrowed below into the pedicel; wall light chestnut-brown, paler below, about 1.5μ thick, much thicker above, 7–12μ; pedicel firm, tinted, often darker than the lower portion of the spore, one half length of the spore or less.

On *Carex acutina, amplifolia, aquatilis, atherodes, Baileyi, comosa, crinita, diandra, exilis, exsiccata, laciniata, lacustris, lanuginosa, magnifica; nebraskensis, nigricans, nudata, Pseudocyperus, retrorsa, rostrata, Sartwellii, siccata, stipata, stricta, trichocarpa, viridula.*

DISTRIBUTION: Across northern United States from Connecticut, New York and Delaware to Washington, Oregon, and Utah, and in Ontario; also in Europe, Siberia, and Japan.

EXSICCATI: Barth, Fungi Columb. *2351, 2655, 3170, 3179, 3349, 3545, 3546, 3571, 3655, 3837, 3838, 3863, 3864, 4066, 4166, 4356, 4377, 4575, 4676, 4979, 5057*—3772, 3973, 4978; Barth. N. Am. Ured. *740, 770, 940, 1081, 1082, 1242*—972; Brenckle, Fungi Dakot. *12, 294*—118; Clements, Crypt. Form. Colorad. *550, 551*—601; Ellis & Ev. Fungi Columb. *1468, 1759*; Garrett, Fungi Utah, *44, 45, 129, 167, 172*; Griff, W. Am. Fungi *339*; Kellerm. Ohio Fungi, *70, 71, 192*—69; Sydow, Ured. *464, 1065, 1575*—2513.

A widely distributed and rather common *Carex* rust. The characteristic features are the moderately large urediniospores with the three, or rarely four, equatorial pores and the long clavate teliospores with the rounded upper cell which is broader and much shorter than the lower cell. On the most of the hosts listed the spores are characteristic and placed here with considerable confidence. The form of *C. nebraskensis,* formerly determined as *C. Hoodii,* was at one time named *Puccinia Garrettii* and described as having amphispores. The tendency of these spores toward thicker walls and retention of pedicels is perhaps better interpreted as a condition of slight immaturity than as a modification toward a resting condition, which we now believe to go with genuine amphispores. Both culture evidence and field observations favor the present disposition.

7. **Puccinia lysimachiata** (Link) comb. nov.

Aecidium Lysimachiae Schw. Schrift. Nat. Ges. Leipzig **1**: 67. 1822. Not *P. Lyssimachiae* Karst. 1879.

Caeoma Lysimachiae Schlecht. Fl. Berol. **2**: 113. 1824.
Caeoma lysimachiatum Link, in Willd. Sp. Pl. **6**^{2}: 45. 1825.
Aecidium Lysimachiae Schlecht.; Wallr. Fl. Crypt. Germ. **2**: 252. 1833.
Puccinia Limosae Magn. Amtl. Ber. Vers. Deutsch. Naturf. u. Aerzte **1877**: 200. 1877.
Dicaeoma Lysimachiae Kuntze, Rev. Gen. 3^3: 467. 1898.

O & I. Pycnia and aecia on *Lysimachia* spp. (Cultures in Europe but not yet made with North American material.)

II. Urediniospores broadly ellipsoid or obovoid, 17–19 × 20–25 μ; wall cinnamon-brown, 1.5–2 μ thick, evenly and rather sparsely echinulate, the pores 3 or 4, equatorial.

III. Teliospores oblong or oblong-clavate, 15–19 × 32–45 μ, rounded or truncate at the apex, usually narrowed below, slightly constricted at the septum; wall dark chestnut-brown, somewhat paler below, 1–1.5 μ thick, much thicker above, 7–10 μ; pedicel light yellow or nearly colorless, about three-fourths length of spore.

On *Carex arcta, atratiformis brunnescens, limosa.*

DISTRIBUTION: Vermont, Connecticut, and Delaware west to Wisconsin, Nebraska, and Illinois; also in Europe.

EXSICCATI: Barth, Fungi Columb. *3848, 4153, 5064*—4152; Ellis & Ev. N. Am. Fungi, 2404.

Cultures in Europe by Magnus (1877) and by Klebahn (Jahrb. f. wissenschaft. Bot. **34**: 396, 1900) have established a connection there between a *Puccinia* on *Carex limosa* and an aecidium on *Lysimachia*. The American specimens here included agree perfectly with the European specimens and are included on the grounds of morphological similarity, even in spite of one negative attempt to make a culture from *C. limosa* on *Lysimachia*. Strong field evidence both from Dearness in Ontario and Bates in Nebraska support the connection. These aecia on *Lysimachia* are undoubtedly distinct from those on *Steironema* which are associated with telial forms on the grass *Spartina*. The aecia have been collected more frequently than the telia.

8. PUCCINIA GROSSULARIAE (Schum.) Lagerh. Ured. Herb. Fries. 60. 1895

Aecidium Rumicis β Grossulariae Pers. Synop. Fung. 207. 1801.
Aecidium Grossulariae Schum. Pl. Saell. **2**: 223. 1803.

Caeoma Grossulariatum Link, in Willd. Sp. Pl. **6**[2]: 59. 1825.
Puccinia Pringsheimiana Kleb. Zeits. Pflanzenkr. **4**: 194. 1894.
Puccinia Magnusii Kleb. Zeits. Pflanzenkr. **5**: 79. 1895.
Puccinia Ribis-nigri-acutae Kleb. Zeits. Pflanzenkr. **6**: 327. 1896.
Puccinia Ribesii-Pseudocyperi Kleb. Prings. Jahrb. **34**: 391. 1899.
Puccinia Ribis-nigri-Paniculatae Kleb. Prings. Jahrb. **34**: 393. 1899.
Puccinia albiperidia Arth. Jour. Myc. **8**: 53. 1902.
Aecidium albiperidium Arth. Jour. Myc. **8**: 53. 1902.
Puccinia riparia Holway, Jour. Myc. **10**: 163, in part. 1904.
Dicaeoma albiperidium Arth. Proc. Ind. Acad. Science **1903**: 145. 1904.
Puccinia quadriporula Arth. Bull. Torrey Club **34**: 586. 1907.
Puccinia Ribesii-Caricis Kleb. Zeits. Pflanzenkr. **17**: 134. 1907.
Puccinia uniporula Orton, Mycologia **4**: 201. 1912.

O and I. Pycnia and aecia on *Ribes* spp. (For cultures see Jour. Myc. **8**: 53, 1902, **11**: 58, 1905, **12**: 14, 1906; Mycologia **7**: 66, 1915.)

II. Urediniospores broadly ellipsoid or obovoid, 15–21 × 19–24 μ (rarely larger, up to 25 × 34 μ); wall golden-brown, 1.5–2 μ thick, finely and evenly echinulate, the pores 3, or sometimes 4, equatorial, or sometimes wholly or in part 1, close to the hilum.

III. Teliospores broadly clavate, 15–21 × 32–58 μ, rounded or truncate at the apex, narrowed below, slightly constricted; wall cinnamon-brown, 1–1.5 μ thick, thicker at apex, 4–10 μ; pedicel one-half length of spore or less.

On *Carex acutina, aquatilis, arctata, arctata* × *flexilis, brunnescens, canescens, castanea, complanata, concolor, conoidea, crinita, cryptocarpa, digitalis, disperma, eburnea, festivella* (formerly det. as *festiva*), *flava, flexuosa, Goodenowii, gracillima, gynandra, Haydeni, hirtifolia, Hitchcockiana, intumescens, Kelloggii, lanuginosa, laxiflora, macrochaeta, magnifica, maritima, Mertensii, monile, nebraskensis, obtusata, pallescens, prasina, retrorsa, scabrata, sitchensis, spectabilis, squarrosa, stipata, stricta, stygia, tetanica, trisperma, typhina, virescens.*

DISTRIBUTION: Northern United States and southern Canada from Nova Scotia and New Jersey west to northern New Mexico, Oregon, and British Columbia, and in Alaska; also in Europe.

EXSICCATI: Barth. N. Am. Ured. *447, 638, 845, 945, 1048,*

1049, *1245*, *1346*, *1547*—222, 637, 844, 944, 1025, 1047, 1152, 1244, 1345, 1446; Barth. Fungi Columb. *2350*, *2447*, *2555*, *2556*, *3060*, *3758*, *4148*, *4461*, *4664*, *4962*—3757, 3843, 3928, 3940, 4147, 4264; Brenckle, Fungi Dakot. *243*, *365*—301; Clements, Crypt. Colorad. Form. 596; Ellis & Ev. Fungi Columb. 1904, 2101; Kellerm. Ohio. Fungi *149*—81, 121; Kellerm. & Sw. Kansas Fungi 27.

A *Carex* rust associated with aecia on *Ribes* is one of the most widespread species both in Europe and America. The study of these forms in America has been attended with some interesting developments. In 1901 when Arthur made the first culture in this country on *Ribes* the resulting aecia were characterized by a decidedly whitish peridium apparently quite unlike the deep orange aecia which are so abundant in North America, and the species was named *Puccinia albiperidia*. During the next few years every effort was made to determine the possible significance of the pale forms obtained by cultures. After six or seven years of culture work it was concluded that the greenhouse conditions such as shade and moist air coupled with a slower development of the fungus tended to produce the differences known to exist between the culture and field specimens. Plants infected indoors and then transferred to the garden gave practically the same appearance as natural infections. The question as to the identity between American and European material remained unsettled and the American rust was still called *Puccinia albiperidia*. In Europe several races were recognized and several names such as *Puc. Ribis-nigri-acutae* and *Puc. Ribesii-Pseudocyperi* proposed by Klebahn came into use. Just about the time that the conclusion was being reached that all *Carex* rusts both in Europe and America, having their aecial stages on *Ribes*, were races of one large species for which the name *Puc. Grossulariae* was the oldest and most appropriate name, another disturbing factor came to light.

While making a special study of the *Carex* rusts possessing 1-celled teliospores (*Uromyces* or *Nigredo*) some specimens were found having one pore, near the hilum, in the urediniospores (see Rhodora **12**: 124–127, 1910). At first this *Uromyces* was known only on *Carex tenuis* but later it was found on *C. gracillima*.

The discovery of such an unusual pore arrangement in a *Uromyces* on a sedge led to a search for urediniospores with this type of pore location in a *Puccinia*. They were found in connection with *Puccinia* forms on the two hosts mentioned and also on *C. pubescens* and *C. pallescens* all of which are hosts for the *Ribes* rust. The urediniospores which have previously been supposed to belong with the telia known to infect *Ribes* possessed three equatorial pores. The discovery of the new pore arrangement even on specimens which had been used for successful cultures suggested that two species must be intermixed. At first the tendency was toward a belief that here might exist two species both with aecia on *Ribes*, the usual one with three equatorial pores and bright colored aecia widespread in both Europe and America, and a less common but perhaps valid one with the single basal pore and pale aecia. Nothing could have been more natural than the suspicion that a structural character in the uredinial stage had now been discovered to accompany the somewhat uncertain character of the aecial stage and that *Puc. albiperidia* was entitled to specific standing. The constant presence of urediniospores with the three equatorial pores in all culture material used for successful inoculations on *Ribes* finally led to the conclusion that the telial stage of which they were a part could account for the cultures, that *Puc. albiperidia* and *Puc. Grossulariae* must after all be synonymous. This view left the form with the basal pore unnamed and unconnected. About this time C. R. Orton in making a study of correlations in the genera *Puccinia* and *Uromyces* reviewed the matter, decided the 1-pored form was a valid species correlated with *Uromyces uniporulus* and supplied the name *Puccinia uniporula* (Mycologia **4**: 201, 1912). Then began definite steps to learn more of its standing through cultures. It is very difficult to secure specimens in which all of the urediniospores have a single basal pore but in 1915 Arthur reports (Mycologia **8**: 130, 1916) that material which may be considered representatives of pure *Puc. uniporula* produced infection on *Ribes* giving aecia identical with those grown previously from material possessing three equatorial pores. There seems to be such a remarkable association of the two types of urediniospores in material capable of producing infection on *Ribes* that the pos-

sibility that we may be dealing with a species having dimorphic urediniospores is tentatively accepted. Whether this will alter the present view of the taxonomic value of pore characters or whether we are in error in uniting these two forms can be revealed only by further investigation. For further discussion of the pore problem the reader is referred to *Mycologia* **7**: 28–33 (1915).

9. **Puccinia eminens** sp. nov.

O & I. Pycnia and aecia unknown.

II. Urediniospores broadly ellipsoid or obovoid, 15–21 × 23–32 μ; wall cinnamon-brown, about 1.5 μ thick, evenly and rather sparsely echinulate, the pores 3, equatorial.

III. Telia roundish or oval, 0.4–1 mm. long, early naked, chocolate-brown, teliospores broadly clavate, 13–24 × 45–67 μ; slightly constricted at the septum, rounded or more often narrowed above, narrowed below; wall chestnut-brown, 1.5–2 μ thick, much thicker above, 7–16 μ; pedicel colorless, length of spore or less.

On *Carex saximontana* Mack. (*C. durifolia subcostrata* Bates).

Type collected in Colorado, May 22, 1909. *E. Bethel;* also collected at Fort Collins, Colorado, May 24, 1896, *C. F. Baker.*

One of the most characteristic features about this species is the broad prominent telial sorus. The urediniospores agree with *Puc. urticata* in pore arrangement but differ in being smaller and darker colored. Acting upon a suggestion made by Mr. E. Bethel an attempt has been made to infect this host, *Carex saximontana,* with aecia from *Ribes longiflorum* but without success (Mycologia **8**: 130, 1916). Specimens may have been distributed as on *Carex Backii* or *C. durifolia* but the Rocky Mountain plant passing under those names is *C. saximontana* Mack.

10. PUCCINIA MICROSORA Körn; Fuckel, Fungi Rhenani *2637.* 1874

Dicaeoma microsorum Kuntze, Rev. Gen. 3[3]: 469. 1898.

O & I. Pycnia and aecia unknown.

II. Uredinia of the typical sort oval or oblong, 0.5–1.5 mm. long, bullate, long covered by the epidermis; urediniospores of the typical sort ellipsoid, 20–26 × 26–30 μ; wall pale yellow or nearly colorless, 1–1.5 μ thick, strongly and sharply echinulate,

the pores obscure, apparently 4, equatorial: uredinia of the modified sort (amphisori) roundish or oval, 0.3–0.6 mm. long, long covered by the epidermis; urediniospores of the modified sort (amphispores) broadly spatulate or obovoid, 20–28 × 32–48 μ; wall chestnut-brown, 2–3 μ thick, slightly thicker above 3–5 μ, sparsely and inconspicuously verrucose, the pores 2 or sometimes 3, equatorial; pedicel persistent, colorless, about length of spore.

III. Teliospores common in the amphisori, oblong or lanceolate, 13–19 × 35–50 μ, rounded or often narrowed above and below, slightly or not constricted at the septum; wall pale yellow, 1–1.5 μ thick, somewhat thicker at apex 2–4 μ; pedicel colorless; about one-third length of spore or less.

On *Carex exsiccata, Frankii, lurida, scabrata, Sprengelii, Tuckermani* (on *C. vesicaria* in Europe).

DISTRIBUTION: Known only from isolated localities in the mountains of Pennsylvania, West Virginia, Virginia, in northern Wisconsin, and on the coast of Oregon; also in Europe.

The discovery, recognition, and finding of additional specimens of this species makes an interesting story. The first specimen was sent from West Virginia by Dr. John L. Sheldon and was on *Carex Frankii*. This being a common host for *Puc. Sambuci* it was examined with the expectation of finding that species. The examination, however, showed only 1-celled, chestnut-brown spores, now known to be amphispores, but which were then taken to be teliospores of some *Uromyces*. They agreed with no known species and the specimen was laid aside as a possible new species. Several years elapsed before anything further came to light. Then Dr. J. J. Davis sent in specimens on *Carex scabrata* and *C. Tuckermani* which were at once recognized as unusual since they possessed three types of spore forms. Urediniospores of an ordinary sort and two-celled nearly colorless teliospores, indicating a *Puccinia* relationship, were present. The most numerous spores, however, were single celled, chestnut-brown, with a thickened apex. Their shape, size, and color indicated at once that they could not be considered mesospores. To be amphispores the wall should have some sort of surface marking and germ pores should be evident and further examination showed clearly that they qualified. The West Virginia specimen was then thought of and a reexamination indicated clearly that the supposed *Uromyces* telio-

spores agreed in every respect with the amphispores of the Wisconsin specimens and that the colorless *Puccinia* spores had been overlooked. The situation was still puzzling but it was evident that another sedge rust with amphispores was added to our list. To Dr. J. J. Davis is due the credit for first suggesting the possibility that his specimens might represent *Puc. microsora* Körn. A comparison of the description in Fuckel, Sym. Myc. **3**: 14 (1875) and a later examination of the specimen in Fungi Rhenani *2637* (1874) left no doubt as to the correctness of the suggestion. The next specimens were soon collected in central Pennsylvania and additional ones have since been sent in from Oregon and Virginia, thus showing it to be present in numerous widely separated localities.

11. PUCCINIA MINUTISSIMA Arth. Bull. Torrey Club **34**: 587. 1907

Aecidium Nesaeae Gerard, Bull. Torrey Club **4**: 47. 1873. Not *P. Nesaeae* Ellis & Ev. 1895.

O & I. Pycnia and aecia on *Decodon verticillatus*. (For cultures see Mycologia **7**: 245. 1915.)

II. Urediniospores globoid or broadly ellipsoid, very small, 12–18 × 16–21 μ; wall golden-brown, 1–1.5 μ, finely echinulate, the pores, 2, slightly superequatorial.

III. Teliospores oblong-clavate, 15–22 × 39–64 μ, slightly constricted at the septum, the apex rounded or obtuse, narrowed below; wall dark chestnut-brown, 1–1.5 μ thick, much thicker above, 9–13 μ; pedicel slightly tinted, about one-half length spore.

On *Carex aquatilis, lasiocarpa*.

DISTRIBUTION: In swamps or bogs of northeastern United States, from Massachusetts and Delaware west to Indiana and Wisconsin; also in Ontario.

EXSICCATI: Barth. N. Am. Ured. *801–951*—1001; Barth. Fungi Columb. 4063, 4102; Ellis & Ev. Fungi Columb. *258* (in part) *1382*; Kellerm. Ohio Fungi 91; Sydow, Ured. *2419*—2549.

This species is especially characterized by the small urediniospores in association with teliospores which are of average size. Its aecial connection also serves to set it apart from any other

species. It is evidently a bog form since both aecial and telial hosts are limited in distribution to swamps, bogs or lake margins.

12. PUCCINIA UNIVERSALIS Arth. Jour. Myc. **14**: 21, 1908

Aecidium Dracunculi Thüm. Bull. Soc. Nat. Moscow **58**: 212. 1878. Not *P. Dracunculi* Auerswald, 1850.

O & I. Pycnia and aecia on *Artemisia* spp. (For cultures see Jour. Myc. **14**: 21. 1908; Mycologia **2**: 224. 1910.)

II. Urediniospores broadly ellipsoid, 15–20 × 20–26 μ; wall cinnamon-brown, 1–1.5 μ thick, rather finely echinulate, the pores 2, equatorial or approximately equatorial.

III. Teliospores clavate-oblong, 16–26 × 35–55 μ, slightly or not constricted at the septum, rounded or obtuse above; wall dark chestnut-brown above, somewhat paler below, 1.5–2 μ thick, much thicker above 7–12 μ; pedicel tinted, one half length of spore or more.

On *Carex diandra, Douglasii, filifolia, Geyeri, heliophila, multicaulis, obtusata, oligocarpa* (Wis.), *petasata, praegracilis, Rossii, stenophylla.*

DISTRIBUTION: Semi-arid regions, North Dakota, and Montana south to Colorado and Utah, locally in Iowa and Wisconsin; also in Asia.

EXSICCATI: Barth. N. Am. Ured. *273, 475, 1080, 1476*—668, 872; Barth. Fungi Columb. *2446, 4275, 4376, 4675, 4980*—4165, 4469, 4765; Brenckle, Fungi Dakot. *106*; Clements, Crypt. Form. Colorad. *593*; Ellis & Ev. N. Am. Fungi *2210*; Ellis & Ev. Fungi Columb. *1641*—1664; Griff. W. Am. Fungi *277a, 360, 360a;* Syd. Ured. *1712*—2435.

One of the most interesting features about this species is its distribution. The fact that it occurs in the central part of North America and also in central Asia and that in each locality the original telial host is *Carex stenophylla* is worthy of note. The probable connection between these aecia and telia was suspected independently in the widely separated locations, by Dr. W. Tranzschel in Turkestan and by Rev. J. M. Bates in Nebraska, and numerous cultures have been since made but only the hosts, *C. stenophylla* and *A. dracunculoides* have been employed successfully. All of the other species of *Carex* are included here

with some uncertainty on account of the lack of culture evidence. They are included on the grounds of morphological similarity. The collection of *C. oligocarpa* is from Wisconsin and is further east than any of the others or any of the aecial collections but appears to belong here. With the exception of a single collection of pycnia on *Artemisia* from Iowa this stage of the species is not known to extend east of the Dakotas and Nebraska.

13. PUCCINIA PHRYMAE (Halst.) Arth. Jour. Myc. **14**:22. 1908

Aecidium Phrymae Halst. Jour. Myc. **2**:52. 1886.

O & I. Pycnia and aecia on *Phryma leptostachya*. (For cultures see Jour. Myc. **14**:22, 1908.)

II. Urediniospores obovoid or broadly ellipsoid, 13–18 × 18–23 μ; wall light cinnamon-brown, 1–1.5 μ thick, finely and rather inconspicuously echinulate, the pores 2, in the upper part.

III. Teliospores clavate oblong, 12–18 × 29–45 μ, roundish or obtuse above, usually slightly narrowed below, slightly constricted at the septum; wall chestnut-brown, 1–1.5 μ thick, much thicker above, 7–13 μ; pedicel nearly colorless, about length of spore.

On *Carex Sprengelii* (*longirostris*).

DISTRIBUTION: In the telial stage known only from Madison, Wis., and Valentine, Nebr., the aecia have been collected also in Iowa, South Dakota, and New York.

EXSICCATI: Barth. N. Am. Ured. *956*, *1067*—253; Barth. Fungi Columb. *3958*.

This is a restricted species as to hosts both for the aecial and telial stages. The urediniospores are very like those of *Puc. asterum* but differences in the teliospores and the interval between the aecial host families seem sufficient to maintain this as a good species.

14. **Puccinia asterum** (Schw.) comb. nov.

Aecidium asterum Schw. Schr. Nat. Ges. Leipzig **1**:67. 1822.

Aecidium Solidaginis Schw. Schrift. Nat. Ges. Leipzig **1**:68. 1822.

Caeoma asteratum Link, in Willd. Sp. Pl. **6**²:51. 1825.

Caeoma (*Aecidium*) *erigeronatum* Schw. Trans. Am. Phil. Soc. II. **4**:292. 1832.

Aecidium Bellidiastri Unger, Exanth. Pfl. 109. 1833.

Aecidium Asteris Thüm. Myc. Univ. *935*. 1878.
Aecidium Lynosyridis Lagerh. Mitth. Bad. Bot. Ver. **46**. 1888.[7]
Puccinia extensicola Plowr. Monog. Ured. 181. 1889.
Puccinia firma Diet. Hedwigia **31**: 216. 1892.
Puccinia vulpinoidis Diet. & Holw.; Diet. Bot. Gaz. **19**: 304. 1894.
Puccinia tecta Ellis & Barth. Erythea **4**: 79. 1896.
Puccinia fusiformis Diet. Hedwigia **36**: 29. 1897.
Aecidium microsporum Diet. Hedwigia **36**: 34. 1897.
Dicaeoma extensicolum Kuntze, Rev. Gen. 3^3: 468. 1898.
Dicaeoma firmum Kuntze, Rev. Gen. 3^3: 468. 1898.
Dicaeoma vulpinoidis Kuntze, Rev. Gen. 3^3: 471. 1898.
Aecidium Grindeliae Sydow, Hedwigia Beibl. **40**: 1. 1901.
Puccinia Caricis-Erigerontis Arth. Jour. Myc. **8**: 53. 1902.
Puccinia Caricis-Asteris Arth. Jour. Myc. **8**: 54. 1902.
Puccinia Caricis-Solidaginis Arth. Bot. Gaz. **35**: 21. 1903.
Puccinia Dulichii Sydow. Monog. Ured. **1**: 684. 1903.
Puccinia Linosyridi-Caricis Ed. Fisher, Beitr. Krypt. Schweiz 2^2: 275. 1904.
Dicaeoma Caricis-Asteris Arth. Proc. Ind. Acad. Sci. **1903**: 147. 1904.
Dicaeoma Caricis-Erigerontis Arth. Proc. Ind. Acad. Sci. **1903**: 147. 1904.
Dicaeoma Caricis-Solidaginis Arth. Proc. Ind. Acad. Sci. **1903**: 147. 1904.
Dicaeoma Dulichii Arth. Proc. Ind. Acad. Sci. **1903**: 147. 1904.

O & I. Pycnia and aecia on *Aster, Doellingeria, Erigeron, Eucephalus, Euthamia, Grindelia, Leptilon, Oreochrysum* and *Solidago* spp. (For cultures see Jour. Myc. **8**: 53–55, 1902; Bot. Gaz. **35**: 15, 16, & 21, 1903: Jour. Myc. **11**: 58, 1904; Mycologia **2**: 224, 1909.)

II. Urediniospores globoid or broadly ellipsoid, 12–19 × 16–23 μ; wall light cinnamon-brown, 1–1.5 μ thick, finely echinulate, the pores 2, in the upper part.

III. Teliospores clavate or clavate-oblong, 12–20 × 35–50 μ, slightly or not constricted at the septum, usually rounded above; wall chestnut-brown, 1–1.5 μ thick, much thicker above, 5–10 μ; pedicel tinted next to the spore, about one half length of the spore.

[7] Reference not verified.

On *Carex alata, albolutescens, athrostachya, brevior, bromoides, canescens, cephaloidea, cephalophora, Crawfordii, cristatella, Deweyana, diandra, disperma, festivella* (formerly det. as *festiva*), *festucacea, foenea, gravida, Hookeriana, Houghtonii, interior, Jamesii, laeviculmis, Leavenworthii, Leersia, Muhlenbergii, Muskingumensis, oligocarpa, Pennsylvanica, planostachys, prairea, retrorsa, rosea, Rossii, scoparia, sparganioides, sterilis, stipata, suberecta, subfusca, Swanii, tenera, triangularis, tribuloides, trisperma, umbellata, varia, viridula, vulpinoidea* (also on *Dulichium arundinaceum*).

DISTRIBUTION: Common from Nova Scotia and Virginia west to the Pacific Coast, less common southward to Alabama and Texas, and in Alaska; also in South America and Europe.

EXSICCATI: Barth. N. Am. Ured. *25, 267, 535, 624, 651, 732, 733, 775, 827, 1031, 1032, 1140, 1180, 1226*—26, 226, 227, 228, 334, 421, 534, 623, 625, 626, 731, 824, 825, 826, 828, 829, 931, 976, 1029, 1030, 1135, 1136, 1138, 1139, 1337, 1442, 4565; Barth. Fungi Columb. *2366, 2574, 3743, 3862, 4274, 4455, 4564, 4755, 4766*—2302, 2448, 2656, 3250, 3251, 3352, 3454, 3455, 3547, 3548, 3744, 3839, 3932, 4053, 4054, 4142, 4257, 4258; Brenckle, Fungi Dakot. *241, 364, 364a*—107, 341, 341*a*; Carleton, Ured. Am. 45; Clements, Crypt. Form. Colorad. 692; Ellis & Ev. Fungi Columb. *1667, 1847, 4143*—64, 1391, 1502, 1705, 1707, 1708, 1955; Ellis, N. Am. Fungi 1019; Ellis & Ev. N. Am. Fungi 2402b; Garrett, Fungi Utah. *66*—65, 131, 155; Griff, N. Am. Fungi *277*—370; Kellerm. Ohio Fungi *89, 174*—150, 151; Sydow, Ured. *2132, 2386, 2411, 2412*—2515; Rab.-Wint.-Paz. Fungi eur. *3833*.

In its present form this is a comprehensive species including several forms which heretofore have passed as good species. Using the aecial hosts chiefly as a guide three distinct forms were recognized during the early stages of culture work in this country. These three forms were named *Puc. Caricis-Asteris, Puc. Caricis-Solidaginis,* and *Puc. Caricis-Erigerontis,* the names indicating the aecial connections. In view of the close relationship of the aecial hosts, the similarity of structure of the uredinial and telial stages, and certain cross cultures it now seems best to consider these forms as races of a single species. An examination of the long list of synonyms reveals several other items of interest. *Puc-*

cinia vulpinoidis will be noted as occurring on the list. This is a form in which the telia are long covered by the epidermis and it was not suspected for many years that it might belong in this group. Numerous cultures were attempted on a variety of plants known to bear aecia but without success. A careful morphological study, fortunate field observations, together with a consideration of the range of hosts finally led to the belief that it belonged here. Cultures as well as hosts indicate that it is the *Solidago* race, all attempts to cultivate it on *Aster* having failed (See Mycologia **7**:79–81). The long covered condition of the telial sorus seems to be associated with structural features of the host. Cultures which have shown that *Puc. Dulichii* is but a race of this large species are interesting because it is the only case where a *Carex* rust has been shown to occur on a telial host not belonging to the genus *Carex*. The report of its culture will be found in the reference to Mycologia above cited.

15. PUCCINIA PECKII (De Toni) Kellerm. Jour. Myc. **8**:20. 1902

Aecidium Oenotherae Mont. Hist. Chile **8**:37. 1852. Not *Puccinia Oenotherae* Vize. 1877.

Aecidium Oenotherae Peck, Ann. Rep. N. Y. State Mus. **23**:60. 1873.

Aecidium Peckii De Toni, in Sacc. Syll. Fung. **7**:790. 1888.

Puccinia ludibunda Ellis & Ev. Proc. Phil. Acad. **1893**:153. 1893.

Aecidium Gaurae Ellis & Ev. Erythea **1**:205. 1893.

Dicaeoma ludibundum Kuntze, Rev. Gen. 3^3:469. 1898.

Dicaeoma Pecki Arth. Proc. Ind. Acad. Sci. **1903**:149. 1904.

O & I. Pycnia and aecia on *Gaura, Onagra, Meriolix*, and *Pacylophus* spp. (For cultures see Jour. Myc. **8**:20. 1902; Bot. Gaz. **35**:13. 1903. Jour. Myc. **11**:58. 1905. **12**:15. 1906.)

II. Urediniospores broadly ellipsoid or obovate, 15–20 × 21–26 μ; wall golden-brown, 1–1.5 μ, finely echinulate, the pores 2, in the upper part.

III. Teliospores clavate-oblong, 13–19 × 32–55 μ, the apex rounded or truncate, usually narrowed at the base, slightly constricted at the septum; wall chestnut-brown, paler below, about 1.5 μ, thicker at apex 7–11 μ; pedicel one half to once length of spore, nearly colorless.

On *Carex Asa-Grayii, chordorrhiza, Hookeriana, lanuginosa, Muhlenbergii, occidentalis, retrorsa, rostrata, siccata, sparganioides, trichocarpa, Willdenowii.*

DISTRIBUTION: Widely distributed from Maine and Virginia west to the Pacific Coast, also south to Alabama and New Mexico; especially abundant from Ohio to Colorado and the Dakotas.

EXSICCATI: Barth. Fungi Columb. *2569, 2570, 3850, 3956*—3460, 3563, 3669, 3955, 4157; Barth. N. Am. Ured. *47, 759, 1058*—53, 252, 560, 652, 955, 1361, 1563; Brenckle, Fungi Dakot. *65*—65a, 112; Carleton. Ured. Am. *5*; Ellis & Ev. Fungi Columb. *1651, 1954*—1604, 1907; Ellis & Ev. N. Am. Fungi *3243*; Ellis N. Am. Fungi 1016; Kellerm. Ohio Fungi *28, 194*—17; Sydow, Ured. *1176, 1576*—2325.

A species of rather common occurrence and of wide distribution. Numerous cultures have clearly established the life history. The urediniospores have the same pore arrangement as those of *Puc. asterum* but the spores are larger. The telia are characterized by being unusually broad for their length, they are oval or even roundish, whereas most sedge rusts have oblong or linear telial sori. On *Carex trichocarpa* the sori of this species are frequently intermingled with those of *Puc. Sambuci.* The small roundish sori of *Puc. Peckii* are usually easily distinguished from the robust elongated sori of *Puc. Sambuci,* even without microscopic characters which would make separation certain.

16. PUCCINIA PATRUELIS Arth. Mycologia **1**:245. 1909.

?*Caeoma* (*Aecidium*) *hieraciatum* Schw. Trans. Am. Phil. Soc. II. **4**:292. 1832.

?*Aecidium* (*Caeoma*) *hieraciatum* Schw. Trans. Am. Phil. Soc. II. **4**:309. 1832.

Aecidium Compositarum Lactucae Burrill; DeToni, in Sacc. Syll. Fung. **7**:799. 1888.

?*Aecidium crepidicolum* Ellis & Gall. Jour. Myc. **6**:31. 1890.

Puccinia Opizii (Bubak, misapplied by) Arth. Jour. Myc. **13**: 194. 1907.

O & I. Pycnia and aecia on *Adopogon* (*Cynthia, Krigia*) *Agoseris, Crepis, Lactuca, Hieracium,* and *Prenanthes* (*Nabalus*) spp. (For cultures see Jour. Myc. **13**:194, 1907, Mycologia **1**: 245, 1909.)

II. Urediniospores ellipsoid or obovoid 15–20 × 20–26 μ; wall golden-brown, about 1.5 μ thick, moderately echinulate, the pores 2, in the upper part of the spore.

III. Teliospores narrowly clavate-oblong, 15–21 × 32–59 μ, rounded or truncate above, slightly or not constricted at the septum; wall chestnut-brown, somewhat paler below, 1–1.5 μ thick, much thicker at apex 5–13 μ; pedicel tinted next to the spore, about three-fourths length of the spore.

On *Carex aenia, brunnescens, Hoodii, illota, praegracilis, praticola, Reynoldsii, Sartwellii, siccata, Sprengelii.*

DISTRIBUTION: Michigan and Illinois westward to Utah, Oregon, and British Columbia.

EXSICCATI: Barth. N. Am. Ured. *758, 1065, 1066, 1165, 1264*—*702*; Barth. Fungi Columb. *3070, 3765, 4366*—3101, 3953, 3954, 4860; Brenckle, Fungi Dakot. *111, 242*—111a, 111b; Clements, Crypt. Form. Colorad. *314*; Ellis & Ev. Fungi Columb. *1902*—1601; Ellis & Ev. N. Am. Fungi. 2993, 3054; Griff, W. Am. Fungi *277c, 339a*—372a; Sydow, Ured. *2323*.

It is here assumed that all the American forms having aecia on members of the Cichoriaceae are referable to a single species. In 1906 cultures were made from an undetermined *Carex* on various species of *Lactuca*. At that time it was believed that the species was the same as one in Europe known to have aecia on *Lactuca* and the name proposed by Bubak, *Puc. Opizii,* was used. Two years later successful cultures were made with Colorado material on *Agoseris* and without suspecting its possible relationship to the so-called *Puc. Opizii* the name *Puc. patruelis* was proposed. When a more comprehensive study was made it became apparent that the American and European species are not identical but that all American forms with aecia on the closely related genera of the Cichoriaceae are without doubt the same species. *Puc. patruelis* then becomes the name, the Schweinitzian names above listed being doubtfully included.

17. PUCCINIA SAMBUCI (Schw.) Arth. Bot. Gaz. **35**: 15. 1903

Aecidium Sambuci Schw. Schr. Nat. Ges. Leipzig **1**: 67. 1822.
Caeoma (*Aecidium*) *sambuciatum* Schw. Trans. Am. Phil. Soc. II. **4**: 294. 1832.

Puccinia Bolleyana Sacc. Syll. Fung. **9**: 303. 1891.

Puccinia Atkinsoniana Diet.; Atkinson, Bull. Cornell Univ. **3**: 19. 1897.

Dicaeoma Bolleyanum Kuntze, Rev. Gen. **3**[3]: 468. 1898.

Puccinia Thompsoni Hume, Bot. Gaz. **29**: 352. 1900.

O & I. Pycnia and aecia on *Sambucus* spp. (For cultures see Bot. Gaz. **35**: 14, 1903; Jour. Myc. **12**: 14, 1906, **13**: 195, 1907; Mycologia **1**: 233, 1909.)

II. Urediniospores lenticular or ellipsoid, 17–21 × 23–32 μ; wall light chestnut-brown, about 1.5 μ thick, rather finely echinulate, the pores 2, in the upper part.

III. Teliospores clavate-oblong or clavate, 15–25 × 42–65 μ, rounded above, usually narrowed below, somewhat constricted at the septum; wall chestnut-brown, 1.5–2 μ thick, much thicker at apex 7–13 μ; pedicel nearly colorless, about length of spore.

On *Carex Asa-Grayii, bullata, comosa, crinita, crus-corvi, Frankii, intumescens, lupuliformis, lupulina, lurida, trichocarpa.*

DISTRIBUTION: Eastern United States and Southern Canada from Nova Scotia and Wisconsin southward to Florida and Texas.

EXSICCATI: Barth. N. Am. Ured. *1569*; Barth. Fungi Columb. *3860, 4865*—3351; Kellerm. Ohio Fungi *57, 88, 148*—3.

A well-defined species both from the point of view of structural characters and aecial connections. It is characterized in the telial stage by the large well-developed sori and by the broad robust spores which are so well rounded above. The usual lenticular shape of the urediniospores is also especially characteristic of this species. No similar species has ever been reported from Europe.

18. PUCCINIA CARICIS-STRICTAE Dietel, Hedwigia **28**: 23. 1889

Uromyces Caricis Peck, Ann. Rep. N. Y. State Mus. **24**: 90. 1872. Not *Puccinia Caricis* Reb. 1804, or Schroet, 1887.

O & I. Pycnia and aecia unknown.

II. Urediniospores of the typical sort, ellipsoid or obovate, 13–20 × 20–25 μ; wall light cinnamon-brown, about 1.5 μ thick, finely and moderately echinulate, the pores 2, opposite, slightly below the equator; urediniospores of the modified sort (amphispores) globoid, obovate, or ellipsoid, 17–24 × 21–31 μ; wall dark cinna-

mon-brown, 1.5–2.5 μ thick, finely verrucose, the pores 2 slightly below the equator; pedicel colorless, semi-persistent, once or twice length of spore.

III. Teliospores clavate-oblong, 16–21 × 32–56 μ, usually rounded above, narrowed or rounded below, slightly constricted; wall light chestnut-brown 1–1.5 μ thick, much thicker above, 5–10 μ; pedicel nearly colorless, length of spore or less.

On *Carex stricta.*

DISTRIBUTION: Northeastern states from Massachusetts to New York and Delaware.

EXSICCATI: Barth. N. Am. Ured. *1033*; Thüm. Myc. Univ. *746*.

An interesting species on account of the presence of amphispores. The amphispores agree with the urediniospores in the arrangement of the pores but differ in being darker colored, in having verrucose instead of echinulate markings, and semi-persistent pedicels. Several collections without amphispores might be included based on the characters of the uredinial and telial stages but not without some uncertainty. A specimen from Connecticut and another from New York, both on *C. stricta*, with only urediniospores and teliospores, doubtless belong here but a specimen from Mississippi on *C. lacustris* has not been included. In spite of an essential agreement in urediniospore characters the geographical distribution, host relations, and lack of amphispores makes the situation too uncertain to list this host. The amphisporic collections are all on *Carex stricta* and are from the following localities: Seaford, Del., *Jackson;* Saratoga County and Albany, N. Y., *Peck;* Wellesley, Mass., *Seymour;* Southold, N. Y., *Latham.* Peck's original name *Uromyces Caricis* was based upon his error of taking amphispores to be one-celled teliospores.

19. PUCCINIA KARELICA Tranz. Acad. Sci. St. Petersburg Bot. **2**: 16. 1904

?*Aecidium Trientalis* Tranz.; Gobi & Tranz. in Scripta Bot. Hort. Imp. Petrop. **3**: 116. 1891.

O & I. Pycnia and aecia on *Trientalis* sp. (Cultures in Europe but not yet made with North American material although supported by field evidence.)

II. Urediniospores globoid or broadly ellipsoid, 16–19 × 20–24 μ; wall cinnamon-brown, 2–2.5 μ thick, finely and moderately echinulate, the pores 3–5, scattered.

III. Teliospores clavate-oblong, 13–21 × 26–48 μ, usually rounded above, rounded or narrowed below, slightly constricted at the septum; wall chestnut-brown, 1–1.5 μ thick, much thicker above, 7–12 μ; pedicel tinted, about one-half length of spore.

On *Carex canescens, paupercula.*

DISTRIBUTION: Nova Scotia to New York and Wisconsin.

The name *Puccinia karelica* Tranz. is applied with some doubt to the *Carex* rust here described. Tranzschel has cultured a form on *Carex limosa* to *Aecidium Trientalis* to which he has given the name *Puc. karelica.* Fraser in Nova Scotia has found good field evidence to the effect that a rust on *Carex paupercula* is connected with an aecial form on *Trientalis americana.* On the strength of the probability that the European and American forms belonging to aecia on *Trientalis* are the same the specific name *karelica* has been taken up. That which makes it seem uncertain is the fact that we find in the *Carex paupercula* rust 3 to 5 scattered pores while Tranzschel states that his form which produces *Aecidium Trientalis* is indistinguishable from *Puccinia Limosae* which has 3 to 4 equatorial pores.

INDEX OF ACCEPTED NAMES OF PUCCINIA ON CAREX

Numerical List	*Alphabetical List*
1. Kellermanii	asterum, 14
2. atro-fusca	atro-fusca, 2
3. macrospora	Caricis-strictae, 18
4. spatiosa	eminens, 9
5. minuta	Grossulariae, 8
6. urticata	karelica, 19
7. lysimachiata	Kellermanii, 1
8. Grossulariae	lysimachiata, 7
9. eminens	macrospora, 3
10. microsora	microsora, 10
11. minutissima	minuta, 5
12. universalis	minutissima, 11
13. Phrymae	patruelis, 16
14. asterum	Peckii, 15
15. Peckii	Phrymae, 13
16. patruelis	Sambuci, 17
17. Sambuci	spatiosa, 4
18. Caricis-strictae	universalis, 12
19. karelica	urticata, 6

INDEX TO THE RUST NAMES LISTED AS SYNONYMS

INDEX TO RUSTS OCCURRING ON THE VARIOUS SPECIES OF CAREX[8]

[8] Only the specific names are used since the hosts all belong to *Carex* and the rusts to *Puccinia*. *Carex* names italicized are regarded as synonyms.

Grossulariae, 8
triangularis Boeckl.
asterum, 14
tribuloides Wahl.
asterum, 14

umbellata Schk.
asterum, 14

varia Muhl.
asterum, 14
variabilis Bailey = aquatilis Wahl.
verrucosa Muhl.
minuta, 5
virescens Muhl.
Grossulariae, 8
viridula Michx.

Willdenowii Schk.

Grossulariae, 8
Tuckermani Dewey
microsora, 10
typhina Michx.
Grossulariae, 8

usta Bailey = praegracilis W. Boott
utriculata Boott = rostrata Stokes

asterum, 14
urticata, 6
vitilis Fries = brunnescens (Pers) Poir
vulgaris Fries = Goodenowii J. Gay
vulpinoidea Michx.
asterum, 14

Peckii, 15

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NEW SPECIES OF PERIDERMIUM

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A description is given in this paper of five new species of foliicolous *Peridermium* on pine in the eastern United States. The first three species have been proven by the writers by inoculations with the aeciospores under controlled conditions in greenhouses to be the aecial forms of species of *Colcosporium*. These are described and named to distinguish them from other species of the form genus *Peridermium* on pine needles. Types of these species have been deposited in the pathological collections of the Department of Agriculture at Washington, D. C.

1. **Peridermium ipomoeae** sp. nov., the aecial form of *Coleosporium ipomoeae* (Schw.) Burrill

Pycnia amphigenous, scattered or frequently numerous and arranged in rows, usually on the same side with or opposite to the aecia on light or yellow green[1] spots in the needles, olivaceous black, 0.11 to 0.36 mm. broad by 0.28 to 0.64 mm. long, averaging 0.24 by 0.41 mm.

Aecia flattened laterally, scattered, usually in a single row, 0.24 to 0.56 mm. high by 0.88 to 2.32 mm. long, averaging 0.4 by 1.6 mm.; peridial cells ovoid to elliptic or rhomboid in face view, mostly overlapping, 16 to 26 by 18 to 47 μ, averaging 21 by 41 μ, with walls 2 to 5 μ thick, the inner closely and finely verrucose; aeciospores ovoid to ellipsoid, 16 to 20 by 22 to 27 μ, averaging 18 by 25 μ, walls colorless and verrucose with somewhat deciduous tubercles 1 to 2 μ in diameter and 1 to 3 μ high.

Peridermium ipomoeae has been collected on the needles of the following species of pine:

On *Pinus echinata* Mill. in Alabama, Arkansas, Georgia, North Carolina, South Carolina, Texas, and Virginia.

On *Pinus palustris* Mill. in Florida and South Carolina.

[1] Colors used are those given in Color Standards and Nomenclature by Robert Ridgway, Washington, D. C., 1912.

On *Pinus rigida* Mill. in Georgia, Maryland, Pennsylvania, and South Carolina.

On *Pinus taeda* L. in Alabama, Arkansas, Florida, Georgia, and South Carolina.

The type of the species is Forest Pathology *22217*, collected by Hedgcock on *Pinus echinata* at East Point, Atlanta, Ga., April 26, 1916.

2. **Peridermium terebinthinaceae** sp. nov., the aecial form of *Coleosporium terebinthinaceae* (Schw.) Arthur

Pycnia amphigenous, few, more or less aggregated near to or on opposite sides from the aecia on the needles, burnt umber to blackish brown, 0.15 to 0.31 mm. broad by 0.25 to 0.61 mm. long, averaging 0.19 by 0.42 mm.

Aecia tongue-shaped, few, usually clustered, fragile, 1.1 to 2.0 mm. high by 0.7 to 1.3 mm. long, averaging 1.4 by 0.8 mm.; peridial cells ovoid to ellipsoid, sometimes angular in face view, 19 to 30 by 39 to 66 μ averaging 30 by 50 μ, slightly overlapping, with walls 3 to 6 μ thick, the inner closely and finely verrucose with more or less deciduous papillae, 0.2 to 0.9 μ thick and 2.5 to 4.0 μ long; aeciospores, ovoid to ellipsoid, 19 to 23 by 30 to 36 μ, averaging 20 by 32 μ, walls colorless, 1.8 to 4 μ averaging 2.8 μ in thickness, closely verrucose with somewhat deciduous tubercles, 0.7 to 1.6 μ thick, and 1.0 to 2.3 μ long.

Peridermium terebinthinaceae has been collected on the following species of pine:

On *Pinus echinata* in Alabama, Georgia, North Carolina, and South Carolina.

On *Pinus taeda* in Alabama.

A form which may be this species has been collected on *Pinus pungens* Michx. f. in Georgia, and on *Pinus virginiana* Mill. in North Carolina.

The type of the species is F. P *20094*, collected by Hedgcock on *Pinus echinata* at Auburn, Ala., April 23, 1916.

3. **Peridermium helianthi** sp. nov., the aecial form of *Coleosporium helianthi* (Schw.) Arthur

Pycnia amphigenous, few, often solitary, usually very near the aecia, light brownish olive to olive, 0.2 to 0.5 mm. wide by 0.3 to 0.6 mm. long, averaging 0.4 by 0.5 mm.

Aecia flattened at first, often becoming tongue shaped when fully mature, few, usually clustered, 0.8 to 1.8 mm. high by 0.5 to 1.2 mm. long, averaging 1.3 by 0.8 mm., rupturing longitudinally with coarsely toothed edges; peridial cells ovoid to ellipsoid, 13 to 25 by 27 to 43 μ, averaging 19 by 40 μ, with walls 2 to 4 μ thick; aeciospores ovoid to ellipsoid, often pointed at one end, 15 to 20 by 20 to 28 μ, averaging 17 by 23 μ, with walls 1.2 to 2.8 μ thick, rugose with numerous small tubercles 0.6 to 1.2 μ thick, 1 to 2 μ long.

Peridermium helianthi has been collected only on *Pinus virginiana* but it probably will be found later on *Pinus echinata*. It has been collected in Pennsylvania, North Carolina, South Carolina, Tennessee, West Virginia, and Virginia.

The type of the species is F. P. *22236*, collected by Hedgcock on *Pinus virginiana* near Greenville, S. C., Apr. 29, 1916.

This species is morphologically very similar to *Peridermium inconspicuum* Long, but proof is lacking of the identity of the two species.

4. **Peridermium fragile** sp. nov.

Pycnia amphigenous, single or few in one or two rows, either near to or on opposite sides from the aecia on yellow green to viridine green areas on the needles, dark olive to olivaceous black, 0.4 to 0.5 mm. wide by 0.5 to 0.9 mm. long, averaging 0.4 by 0.6 mm.

Aecia small and inconspicuous, flattened laterally, few, scattering or in groups, 0.4 to 0.5 mm. high by 0.8 to 2 mm. long, averaging 0.4 by 1.3 mm.; peridia rupturing longitudinally with irregularly notched edges; peridial cells slightly overlapping, ovoid to ellipsoid in face view, frequently pointed at both ends, 17 to 25 by 37 to 46 μ, averaging 21 by 41 μ, with walls 4 to 8 μ thick, the inner verrucose with numerous, crowded papillae 1.1 to 1.9 μ thick and 4.1 to 5.6 μ long, averaging 1.4 by 5.0 μ; aeciospores ovoid to ellipsoid, 18 to 22 by 25 to 34 μ, averaging 21 by 31 μ, with walls 2 to 3 μ thick, the outer surface closely verrucose with irregularly arranged rows of more or less deciduous tubercles, 1.8 to 2.4 μ thick, and 1.7 to 3.2 μ long.

Peridermium fragile has been collected on *Pinus palustris* in Florida and Georgia, *Pinus taeda* in Florida, and on *Pinus rigida* in New Jersey.

The type of the species is F. P. *17426*, collected by Hedgcock on *Pinus palustris* at Brooksville, Fla., Mar. 11, 1915.

5. **Peridermium minutum** sp. nov.

Pycnia solitary or few, or sometimes lacking, tawny to buckthorn brown, 0.2 to 0.4 mm. wide by 0.3 to 0.5 mm. long, averaging 0.3 by 0.5 mm.

Aecia scattered, usually in a single row on the outer side of the leaves, low and inconspicuous, flattened laterally, 0.3 to 0.7 mm. broad by 0.5 to 1.2 mm. long by 0.3 to 0.5 mm. high, averaging 0.5 by 0.7 by 0.4 mm.; peridia very delicate, rupturing longitudinally with finely fimbriated edges which recurve on maturity; peridial cells ovoid, ellipsoid, or rhomboid in face view overlapping but very little, if at all, 18 to 28 by 35 to 70 μ, averaging 21 by 48 μ, with walls 2 to 4 μ thick, the inner finely verrucose with papillae; acciospores ovoid to ellipsoid to cylindric, sometimes pointed at one end, 14 to 18 by 26 to 38 μ, averaging 15 by 33 μ, with colorless walls 2 to 4 μ thick, the outer verrucose with blunt tubercles 0.8 to 1.4 μ in diameter, 2.7 to 3.4 μ long.

Peridermium minutum has been collected on *Pinus glabra* Walt., and *Pinus taeda* only in Florida.

The type specimen is F. P. *20768*, collected by Hedgcock on *Pinus glabra* near Gainesville, Fla., Mar. 15, 1916.

In the study of various species of *Peridermium* it is found that the pycnia possess good diagnostic characters, not heretofore recognized, and a key to the species known in the eastern United States is in process of preparation in which these with other characters will be used.

It is also found that the peridial cells vary greatly in different parts of the same peridium. Even when cells from the sides and base of the peridium are twice as long as they are wide, the cells at and near the top are only about half as large, with width and length about equal and with walls much thickened. Since some of the basal cells can practically always be found it seems better to base the measurements on them alone.

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METHODS FOR SATISFACTORY FIELD WORK IN THE GENUS RUSSULA

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There are undoubtedly many unreported and undescribed species of *Russula* in the United States. While it is true that the color variations in the same species and the absence of striking characteristics make the identification more difficult than in some genera, the proper study of the species in the field will overcome this difficulty to a large extent. When one is collecting in a rich field, there is always a temptation to sacrifice the quality of the work to the quantity of material taken. But one should remember that five collections of *Russula* with complete field notes are of more value than any number of specimens without full descriptions.

The first essential in collecting is to keep each collection separate. One method is to put each collection in a paper bag of proper size; another, used by the Boston Mycological Club, consists in wrapping the specimens in waxed paper. Each number should be acompanied by a statement of the locality, date, habitat and habits of growth. When possible it is desirable to obtain subsequent collections from the same place so as to accumulate data as to the season of growth, and any variations in color, size, or habit.

The most important fact to be learned in the field is the character of the *taste*. Both young and mature mushrooms should be tasted. I have found it preferable to taste the pileus rather than the stipe, since when the context is only slightly acrid the taste is more pronounced in the pileus. While it is advisable to taste cautiously at first lest the context prove to be very acrid, one should chew enough to determine beyond question whether the taste is acrid, mild, astringent, bitter, or in any way disagreeable.

While examining the context one should also observe whether the broken flesh changes color. This change is not always rapid.

Sometimes it requires two minutes. If the color then persisted, there would be no special need to watch the changes occur, but in several cases a secondary change occurs which obscures the first discoloration. Prof. H. C. Beardslee, of Asheville School, Asheville, N. C., seems to have been the first one to publish any record of an intermedate change to red in *Russulae* outside of the group to which *Russula nigricans* (Bull.) Fr. belongs. In Mycologia **6**:91. 1914 he described *R. rubescens,* which differs from *Russula obscura* Rom. in that the wounds become *red* and then gray or black. In the summer of 1916 I determined to look for intermediate color changes in the flesh of all *Russulae.* I found that specimens exactly like what I had formerly referred to *R. obscura* Rom. showed within two minutes after the flesh had been broken a change to peach-red, but that after about five minutes the wounds had become gray. Prof. Beardslee says in regard to specimens of these which I sent him: "They seem to be the same as my *R. rubescens.*" Miss Ann Hibbard, a member of the Boston Mycological Club who spent part of the summer collecting with me, observed the same change to red and then to gray in the broken flesh of a yellow *Russula* conforming in all other respects to *R. flava* Lindbl. The question has naturally arisen, does the flesh of *R. flava* become red, then gray, and I am awaiting an answer to this question from Prof. Romell before pronouncing this a new species. In October Miss Hibbard wrote me from Boston: "There were two more *R. rubescens* at the club exhibition yesterday which were called *R. obscura,* but the stems turned red when I scratched them." Since in other characteristics *R. rubescens* often resembles *R. obscura,* it is mostly impossible to tell whether herbarium material which has been identified as *R. obscura* is this species or *R. rubescens.* Enough has been said to show the importance of the most careful observations regarding the change of color in the broken flesh.

The color of the lamellae in both young and mature specimens should be ascertained, as in some species the color of young lamellae is yellow while in others it is white at first, becoming yellow with maturity. The arrangement of the lamellae affords a permanent characteristic which can be used in classification.

but this can be seen much plainer in the fresh specimen than in the dried state. In some all the lamellae reach the stipe and are simple; in others shorter lamellae are promiscuously scattered among the long ones; in others the short and the long lamellae are systematically arranged. Sometimes lamellae fork near the stipe only, and sometimes they fork once or twice midway to the margin. When the time at one's disposal is short these characteristics may be left to observe in the dried state if the mushrooms are properly dried.

It is, of course, necessary to describe the color of the pileus while the mushrooms are fresh. Not only may the color change during one night after they have been collected, but the color of the dried specimens is often very different from that of fresh ones. Water-color sketches of *Russulae* have great value in expressing the color. One who is collecting fleshy fungi should follow some standard color nomenclature in describing the color. While the color of some species varies through a wide range, there is generally a certain key note of color, as it were, throughout the variation, or certain limitations in variation from which one learns in time to recognize the species. Again there is some other constant characteristic which distinguishes a species in spite of the color variation, as the odor and sordid discoloration of *R. atropurpurea* Pk., or the slight odor and soapy or sticky feeling of the stipe of *R. Mariae* Pk. While studying the color of the pileus one should determine to what extent the cuticle can be peeled off, and a specimen showing the result of this attempt should be included in the collection. Whether the surface is viscid or not is important and can be best observed in the field. The glabrous, pruinose, tomentose, or areolate character of the surface may be permanent, or the surface may change with age or with drying, so that it is advisable to observe the surface of the young and mature specimens in the fresh state.

Of as great importance as the taste and the changing color of the context is the spore color. Sometimes it is difficult to obtain a spore print after specimens have been brought in, and in order to be sure of a satisfactory print, it is a good plan to place a mature pileus on a piece of clear white paper when the plants are

put in the bag in the field. By the time one is ready to study the specimen at home a good print will probably have formed. To be satisfactory, a thick layer of spores should have fallen and the color should always be described from such a layer, as otherwise ochraceous spores may seem pale when only a few have fallen. If only a scattering of spores can be obtained, one may scrape some up with the point of a knife and rub them off in mass on the paper. The spore print should then be folded and either pinned to the description or placed in a small envelope bearing the collection number. Before the print has been kept very long the color should be named according to some standard of color nomenclature, since the spore color may change in time, although if a fixative has not been used there is less danger of this.

There are some general suggestions which may be given. Not only is it important to keep collections in the field distinct, but they must not be mixed during the drying process. They should be tagged with the identification number before placing on the drying screen. As soon as they are thoroughly dried each collection should be wrapped or boxed. I have found that specimens properly dried and taken care of in this manner keep perfectly without the addition of naphthalene. In any case it is preferable not to add the naphthalene until after the specimens have been identified, as it obscures any natural odor which the plants may have. In regard to odor, one should examine the mushrooms in the field, when drying, and after they are dried to detect any characteristic odor.

It is a mistake to assume upon a glance in the field that one group of *Russula* is the same as another taken in some other place or at another time and to limit the description of it to "the same as No. x," since one may be mild, the other acrid; one may have white spores, the other yellow spores; one may have persistently white flesh, the other flesh changing from red to gray or merely to gray. Neither is it a good plan to make a composite description of a lot of fresh mushrooms assuming them to be the same. Each collection should have its own description and if all the descriptions agree in the essential points and the fresh mushrooms

of the different collections as well as the dried ones also agree, then one can arrange a complete description of the species from the descriptions of the various collections taken either the same day, or the same year, or even in different years.

To summarize, each collection of *Russula*, to be of value, should include a number of specimens, where possible, showing a gradation from young to mature forms and any variations in color or size, one which shows to what extent the cuticle is separable, and a lengthwise section. Accompanying the specimens should be a spore print, and a description containing the points outlined above. To these a water-color sketch would be a valuable addition.

Many of the species of *Russula* are edible and occur in some abundance through July and August and the early part of September. For the benefit of any who may wish to attempt to identify species of *Russula* which they may find, I append a short bibliography of American literature on the genus.

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A NEW LEAF-SPOT DISEASE OF POLYGONUM PERSICARIA

P. J. O'Gara

(With Plate 10)

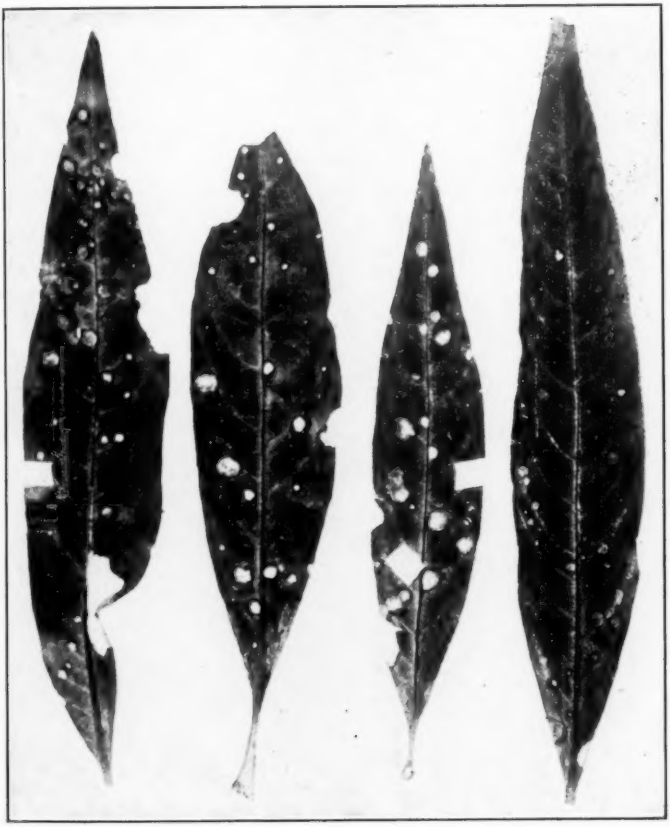
In July of 1914 and August of 1916, Mr. W. W. Jones, botanist in the department of agricultural investigations, American Smelting & Refining Company, made collections of *Polygonum persicaria* L. showing an apparently new leaf-spot. An examination of the literature indicates that this leaf-spot disease has not been previously noted and that the organism is an undescribed species of *Septoria* quite different from the species of *Septoria* described as occurring upon Polygonum or related genera. From field observations it would seem that this type of leaf-spot is rather rare, only two small collections having been made as noted above. The description of the species is as follows:

Septoria persicariae sp. nov.

Maculis amphigenis subcircularibus, 1–8 mm. diam., sparsis v. saepe confluentibus, rubiginoso-brunneis dein centro griseo-brunneis v. griseis, anguste purpureo v. violaceo-limbatis; *pycnidiis* amphigenis, parcis v. numerosis, sparsis v. aggregatis, immersis, membranaceis, brunneis v. atro-brunneis, globosis 50–120 μ diam., osteolo depressis v. parvulo pertusis; *sporulis* hyalinis filiformibus utrinque obtusis v. attenuatis v. saepe uno apice latoribus altero gradatim attenuatis (sub-clavulatis), rectis, curvis v. saepe flexuosis, continuis v. indistincte pluriseptatis, saepe minute guttulatis, 17–60 $\times$ 1–3 μ, cirrose expulsis; basidiis non vivis.

Hab. in foliis vivis *Polygoni persicariae*, Salt Lake Valley, Utah, Amer. Bor. (Wyatt W. Jones).

Department of Agricultural Investigations,
American Smelting & Refining Company,
Salt Lake City, Utah



Photograph of type specimens of leaves of *Polygonum persicaria* L. infected with *Septoria persicariae* O'Gara. From the collection of Wyatt W. Jones, Salt Lake Valley, Utah, August 23, 1916

NEW JAPANESE FUNGI

NOTES AND TRANSLATIONS—II

Tyôzaburô Tanaka

Phytophthora Allii K. Sawada sp. nov. in Nôji Shikenjô Tokubetsu Hôkoku (Special Report Agric. Exper. Station), Taiwan (Formosa), No. 11, p. 59–60, pl. 1–2. T. 4, iii, Mar. 1915.

Forming a cottony white mycelial mass on diseased portions of leaves of *Allium fistulosum*. Hyphae filiform, hyaline, thin-walled, with granular contents, continuous when young but always septate when old, much branched, 3–8 μ across, penetrating the cell walls of the host tissues. Haustoria not observed. Conidiophores appear through stomata of the host or sometimes break through the epidermal tissue, mostly accompanied by hyphae; conidiophores filiform, fine, single or branching pseudo-dichotomously or rather irregularly ramose, 140–480 × 4–6 μ; conidia terminal, globular, ovoid, obovoid or lemon-shaped, hyaline, apically mamillate with a hemispherical papillum 5–10 μ high, 40–74 × 30–50 μ, averaging 49.4 × 36.5 μ, with or without a thickened septum at the base; falling off not rarely with a portion of persistent conidiophore at the end, producing 15–60 zoospores or germinating with germ tube.

Oogonia formations were observed in cultures on media made of bean agar-agar, and lima bean agar-agar. Oogonia spherical, thin-walled, diam. 17–26 μ (average 20.7 μ), containing one oospore; oospores spherical, colorless or pale-honey-yellow, diam. 14–23 μ (averaging 16.9 μ), walls 0.5–1.5 μ thick. Antheridia surrounding tightly the stalk of oogonia then becoming attached close to the wall of oogonia at the lower portion not far from the juncture of the stalk, usually round to obovoid, 8–18 × 10–14 μ.

Parasitic on the leaves and flower stalks of *Allium fistulosum*.

Type locality: Taihoku-chô Chônaiho-shô, Taiwan (Formosa), collected by K. Sawada, Feb. 17, 1913 and July 3, 1913.

Illustrations: 45 black and white lithographic figures showing detailed structure of the fungus.

An attempt to inoculate the ordinary onion (*Allium Cepa*) with this fungus was not successful, so it seems that the infection is

limited to the Japanese welsh onion (*Allium fistulosum*); the only plant susceptible to the disease in inoculation tests was *Epiphyllum truncatum* (*Cactaceae*). The disease is not at present widely distributed and the injury not very serious. It is desirable to eradicate it before it spreads to other localities.

The paper gives a review of the genus *Phytophthora* and allied genera; the following species are discussed:

Phytophthora cactorum (C. et L.) Schroet., *P. cactorum* (C. et L.) Schroet. var. *Arecae* Colem, *P. colocasiae* Rac., *P. faberi* Maubl., *P. infestans* (Mont.) de Bary, *P. nicotianae* Breda de Haan, *P. parasitica* Dast, *P. Phaseoli* Thaxt., *P. Syringae* Kleb., *P. Thalictri* Wils. et Davis, *Kawakamia Cyperi* (Miy. et Ideta) Miyabe, *Pythiacystis citrophthora* Smith.

PHYTOPHTHORA MELONGENAE K. Sawada sp. nov. in Nôji Shikenjô Tokubetsu Hôkoku (Special Report Agric. Exper. Station), Taiwan (Formosa) No. 11, p. 77–79, pl. 3. T. 4, iii, Mar. 1915.

Hyphae intercellular in the host tissue or freely penetrating the cell wall, much branched, not septate in juvenile stage, but septate when mature; aerial hyphae mostly not branching, usually attaining a considerable length, nearly uniform in diameter, the base always irregularly twisted, swelled or short-branched, and very characteristic; diam. of hyphae 4–8 μ; haustoria none. Conidiophores hardly distinguishable from aerial hyphae, filiform, delicate, very much elongated, the shortest measuring 80 μ in length, 3–5 μ across; conidia spherical, broad-oval or oval, 24–72 $\times$ 20–48 μ, average 42.4 $\times$ 33.9 μ, with apical hemispherical papillae 3–5 μ high, producing several to 40 zoospores; zoospores ovoid or ellipsoid, 10–11 $\times$ 8 μ, with 2 cilia; chlamydospores yellowish-brown, spherical, 25–42 μ in diam.; oogonia formed in cultures on bean agar-agar medium, spherical, 18–23 $\times$ 20–24 μ, containing one oospore; oospore spherical, walls 2 μ thick, colorless to very pale yellowish-brown, diameter 17–21 μ. Antheridia not formed on the same hyphae that bear the oogonia but on the end of other hyphae, surrounding tightly the oogonial stalk and attached to the wall of oogonia at the juncture with the stalk, oblate spheroidal or nearly spherical, 10–14 $\times$ 12–16 μ.

Parasitic on the fruit of *Solanum Melongena* (Egg plant).

Type locality: Taihoku-chô, Chônaiho-shô, Taiwan (Formosa), June 18, 1914, July 10, 1914, and Sept. 6, 1914.

Illustrations: 24 black and white lithographic figures showing detailed structure of fungus.

Not only the Formosan white egg plant but all other Japanese varieties are susceptible to this disease and in one case 60 to 70 per cent. of the crop was lost. Inoculation tests proved that other solanaceous plants are susceptible and such plants as tobacco, tomato and even Irish potato were attacked. Among plants belonging to other families, figs, *Areca Catechu*, and *Hibiscus esculentum* were counted as susceptible hosts, and in a lesser degree *Epiphyllum truncatum* and *Ricinus communis*.

ZUKALIA NANTOENSIS K. Sawada sp. nov. in Nôji Shikenjô Tokubetsu Hôkoku (Special Report Agric. Exper. Station), Taiwan (Formosa), No. 11, p. 123, pl. 4, figs. 14–18. T. 4, iii, Mar. 1915.

Epiphyllous, sometimes also hypophyllous, lichenous, spreading over an area 2–5 mm. across, tightly coalescent; hyphae fuliginous, thick-walled, 8 μ across, septate and sparsely furnished with hyphopodia, oblong bodies with rounded end usually on a stalk 18–25 μ long. Pycnidia and perithecia grow on the mycelial layer, both orbicular black bodies, mostly sessile, sometimes on stalks 18–25 μ long; pycnidia 63–95 μ, containing numerous pycnospores; pycnospores pale-brown, ellipsoid to oblong, glabrous, unicellate, bi-nucleate, 6–8 $\times$ 3–4 μ; perithecia 132–180 μ in diameter, with numerous asci; asci oblong-clavate, ovoid-oblong, with short stipules, hyaline, 33–49 $\times$ 10–12 μ, containing 8 spores; ascospores oblong to short clavate, septate at the middle, colorless, blunt or obtuse at both ends, 9–13 $\times$ 3.5–5 μ.

On leaves of *Thea sinensis*.

Type localities: Nantô-chô, Gyochi, Taiwan (Formosa), Oct. 30, 1907, Suzuki, Rikiji; Nantô-chô Shinjô, Taiwan (Formosa), Oct. 17, 1913, Fujikuro, Yosaburô.

This fungus causes the Susu-byô (Sooty mould disease) of tea in Formosa, mostly occurring with *Zukalia Theae* K. Sawada, *Scorias capitata* K. Sawada, and *Capnodium Footii* Berk. et Desm.

MASSARIA PHORCIOIDES I. Miyake sp. nov. in Sangyô Shikenjô Hôkoku (Technical Report, Imperial Sericultural Experiment Station), Tôkyô, Japan, 1[5]: 316, pl. 16, figs. 4–5. T. 5, xii, Dec. 1916.

Perithecia scattered over the twigs forming black spots, the diseased cortex of the twig being very easily separated from the wood. Perithecia hypoepidermal, opening with ostiola, consisting of pseudo-parenchymatous tissue, black, spherical or ellipsoid, 250–300 μ in diameter and 200–250 μ in height, containing few asci; asci clavate to elliptic, 110–140 $\times$ 35–42 μ, short stipitate, with 8 biseriate spores, paraphysate; ascospores fusiform, dark-yellowish-brown, 1-septate and 3–5 nucleate at first, then 4, rarely 3–5 septate, constricted only at the middle septum first formed, 45–52 $\times$ 19–22 μ, covered with a gelatinous envelope; paraphyses filiform, stout, with granular contents.

On twigs of *Morus alba,* possibly parasitic (common).

Type localities: Gifu-ken (prefecture) Kaidzu-gun Kaisai-mura, Mar. 1909, I. Miyake; Fukui-ken (prefecture) Tsuruga, Mar. 1909, K. Hara; Fukushima-ken (prefecture) Fukushima-shi and Yamagata-ken (pref.) Yamagata-shi, Mar. 1915, I. Miyake; Akita-ken (pref.) Akita-shi, and Ôtate-chô, Iwate-ken (pref.) Fukuoka-chô, and Kyôto-fu (pref.) Ayabe-chô, Apr., 1915, I. Miyake.

Distribution: China, Japan.

Illustrations: 2 black and white lithographic figures showing perithecium and ascospores.

At the side close to the perithecia, a conidial form usually occurs which consists of rosy-colored, caespitose conidiophores and spherical or short elliptical hyaline conidia. The relation between this form and the ascogenous form here described has not yet been studied. The characteristic perithecial position of this fungus can be seen with the naked eye if we examine carefully the blackened discoidal surface of the diseased spot on which a highly darkened spot at the central part is to be observed which represents the perithecial body underlying the epidermal tissue.

MASSARIA MORI, I. Miyake sp. nov. in Sangyô Shikenjô Hôkoku (Technical Report, Imperial Sericultural Experiment Station). Tôkyô, Japan, 1[5]: 319, pl. 17, figs. 12, 13, 14. T. 5, xii, Dec. 1916. (Japanese.)

Perithecia covered by epidermis which is pierced by shortly projecting ostiola, scattered or 2–3 together, mostly surrounded by black hyphal substance pseudo-parenchymatous in appearance, globoid or ellipsoid, 400–600 μ in diam.; perithecial walls consist-

ascospores biseriate, nearly fusoid, somewhat acute but inconsiderably thickened at one end, 3-septate, constricted at the middle septum first formed but not at others, first nucleate with few large hyaline globules, then coarsely guttulate with yellowish-brown homogeneous contents, and finally opaque with blackish-brown fine granules, 55–70 × 18–23 μ, covered by a gelatinous envelope; paraphyses forked, 2.5–3.0 μ across, colorless and far longer than the asci.

On twigs of *Morus alba*.

Type localities: Akita-ken (prefecture) Yuzawa-chô, Mar., 1915, I. Miyake; Kyôtô-fu (pref.) Ayabe-chô, Apr., 1915, I. Miyake.

Illustrations: 3 black and white lithographic figures showing detailed structure.

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